PLANNING FOR A CHANGE IN RECRUIT PATIENT MIX

NAVAL HOSPITAL
GREAT LAKES, ILLINOIS

A Graduate Research Project

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of

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by

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CHAPTER I

INTRODUCTION

Conditions Which Prompted This Study

The Naval Hospital, Great Lakes, Illinois is charged to provide health care support to all of the Navy organizations at the Naval Training Center at Great Lakes. One of the principal Commands is the Recruit Training Command (RTC) which is the largest of three recruit training depots in the Navy. At any given time there are about 8,000 (all male) recruits undergoing various levels of training at RTC Great Lakes. Presently, all female recruits are trained at RTC Orlando, Florida. By the beginning of FY 87, the mix of recruits at Great Lakes will change to approximately 10% female as the Navy adopts a policy of apportioning female recruits evenly among the three RTC's. This will amount to 800 female recruits aboard at any time, with a total of about 4,000 during the course of a year. The total number of recruits at the RTC Great Lakes will not increase, which means that these females will replace 4,000 males who will, in turn, be training at Orlando. The Commanding Officer, Naval Hospital, Great Lakes is interested in making preparations for any changes that may be necessary as a result of this change in patient population.

Problem Statement

To assist in planning for a change in patient mix from 100% male to 90% male, this study will analyze male/female morbidity and workload data

for a recruit population and then to estimate possible changes in workload/morbidity patterns.

Objectives

1. Review the literature regarding sex differentiated morbidity of recruit or similar patient populations.

2. Measure and compare the quantity and incidence rate of outpatient workload/morbidity and admissions of male and female recruit patients stationed at RTC Orlando, based on existing reportable data from FY 1985.

3. Measure the quantity and incidence rate of outpatient workload/morbidity and admissions of male recruit patients stationed at RTC Great Lakes, based on existing reportable data from FY 1985.

4. Use the 1985 data to make projections about the proposed male/female recruit population at RTC Great Lakes and compare with the 1985 population.

5. Based on examination of the data, make general recommendations to the Commanding Officer, Naval Hospital, Great Lakes as to any medical and/or support services that may be needed by the new population.

Criteria

1. In order to achieve statistical significance, comparisons or differences must be significant at the .05 confidence level.

2. In addition to statistical significance, this project will assess the practical significance of the data. The practical significance of a difference will be determined by local experts who have had experience in a given area. For example, senior laboratory personnel will determine if an

increase of 100 work units per month, although statistically significant, is of real, practical concern to their operation.

3. Recommendations made to the Commanding Officer, Naval Hospital, Great Lakes will be based on significant differences that are foreseen to be health care requirements of the newly integrated population.

Assumptions

1. It is assumed that basic training programs will not change as a result of redistribution of the female recruit population or for any other reason.

2. Given a virtually random method of selection of each recruit's training site, the basic demographic characteristics of the Orlando patient population will not be different from those of recruits undergoing training at Great Lakes.

3. In order to more accurately project future workload, current policies in effect regarding screening of sick call patients, fitness for duty, enlistment standards, etc. will remain basically unchanged.

4. The current edition of Naval Medical Command Instructions 6300.2A and B which define reportable outpatient workload, morbidity and admissions will remain unchanged. It is assumed that both Orlando and Great Lakes interpret these instructions similarly such that data has a basis for comparison.

5. It is assumed that Fiscal Year 1985, was a representative year upon which to base projections for Fiscal Year 1987.

Limitations

1. Recruits are intentionally subjected to circumstances which are different than normal Navy life. Due to the unique and rigorous nature of this training, it is unlikely that rates and projections will be applicable to any other population, such as females at large in the Navy or another military service.

2. Each RTC medical facility has some differences in size, staff and services offered to recruits. It is possible that variability in the standard of medical practice or other policy/procedural differences might weaken the strength of projections.

3. As a limitation placed on this project by higher authority, any recommendations to adapt to the changed patient population may not include increase in the total of military medical personnel assets.

Review of the Literature

Previous research efforts that address aspects of male/female recruit morbidity concentrate on specific topics in recruit medical care such as orthopedics, podiatry, psychiatry, etc. Although numerous authors have made contributions to the literature on the general topic of sex differentiated morbidity, as might be expected, the most relevant studies arise from military medical research.

1. Comprehensive Studies.

Some comprehensive studies have been undertaken and published by the Naval Health Research Center in San Diego, California. Some of these studies provide insight about the morbidity differences that may arise

during this project. Some of these studies compare morbidity among females and others compare males to females.

Hoiberg noted that, among females in the Navy from 1966-1975, highest rates were noted for pregnancy/childbirth complications, respiratory disease, infective disease, mental disorders and genitourinary disease.[1] However, pregnancy complications and mental disorders were decreasing because of legislative changes regarding abortions in federal facilities and shifts to use of outpatient care for treatment of psychological disturbances. This study also revealed that 25-30% of the total female force was hospitalized at some time during the period, compared to only 11-13% of the total male force.

Further development of the comparison of hospitalization rates followed in 1980 when Hoiberg noted that recruit female hospitalization rates were higher than male recruits in virtually all diagnostic categories.[2] Substantially higher rates for genitourinary disorders were attributed to the "vulnerability of the female reproductive system to dysfunction".[3] Higher female rates for digestive disorders were explained as a typical reaction to a stressful change in life style, i.e., joining the Navy. However, another generally frequent problem, foot blisters/cellulitis, were found to be the same for the two sexes.

In another article based on the same data, Hoiberg examined the incidence of accidental injuries. She noted that women recruits had the highest hospitalization rate among all Navy females for accidental injuries during a 1973-75 time period.[4] Although female recruits' injury rate is highest among Navy women, Hoiberg and Thomas carried the analysis a step further. They discovered that Navy male recruits have a rate of

hospitalization for injuries that is three times higher than females.[5] Army medical research came up with different findings for training injuries in 1980 when Kowal found that 54% of the sample female trainees versus 26% of the males sustained training injuries.[6] Poor physical conditioning upon entry was seen to be a reliable predictor of these injuries.

2. Orthopedic Studies.

In addition to the general injury category, there are studies that have focused in the area of orthopedic and podiatric conditions. In 1976, Protzman and Griffis found a female-to-male ratio of 12 to 1 for lower extremity stress fractures among cadets at the U.S. Military Academy.[7] Another study by Reinker and Ozburne published in 1979 of basic trainees at Fort Jackson, South Carolina demonstrated that women had 2.9 times the orthopedic stress reactions as men, 5.3 times the incidence of Achilles tendinitis and twice the incidence of chondromalacia patellae.[8] Schmidt-Brudvig, Gudger and Obermeyer conducted a similar study on trainees at Fort McClellan, Alabama in 1981. Their findings showed that females had greater than three times the incidence of stress fractures than males.[9] All of these orthopedic-related studies point to females as being more susceptible to musculoskeletal disorders.

3. Psychological Studies.

There are few studies that compare the psychological reactions of males and females during recruit training. In 1975, Kowal, Patton and Vogel conducted psychological tests on a sample of male and female Army recruits at Fort Jackson, South Carolina. They found considerable evidence of physiological differences between the two groups. At the end of

training they found that there were indications of "growth experience" (psychological/emotional) for the males but no change for the females.[10] This may reflect different maturity levels for the two groups, but does not provide indications of psychological morbidity for the project at hand.

There are some other studies that do shed a little more light on the subject. In 1975, Schuckit and Gunderson released their study of psychiatric admission rates for Navy men and women. For those in pay grade E-1 (recruits), the admission rate was four times higher for females.[11] McCarroll, Kowal and Phair used the Health Opinion Survey to screen for psychiatric illness among male and female recruits where the higher the score, the greater likelihood of becoming a psychiatric case. Based on the results of the Health Opinion Survey, it was discovered that the females scored higher and had a higher risk of illness or injury than males.[12] This may be attributable to increased use of outpatient care or better overall mental health of the females joining the Navy. Accurate explanations in the psychological arena are often more difficult to establish compared to other medical specialties.

Another fundamental reason for difficulty in this area can be attributed to changes in diagnostics. Psychological findings in these studies precede a change in psychiatric diagnostic categories adopted by the American Psychiatric Association in 1980. Little further research into recruit psychiatric morbidity is evident since the adoption of these new categories.

4. Theoretical Perspective.

Many authors refer to the work of Nathanson for theoretical discussion of the reasons for differences in morbidity and use of health care.[13] Nathanson reports three possible reasons for women reporting more illness than men: 1) it is culturally more acceptable for women to be sick; therefore, they are less inhibited to seek care; 2) the sick role is more compatible with women's other roles in society; and 3) women do, in fact, have more illness than men due to stressors as they function in their roles in society. In any case, her review of the data indicated that women utilize health care service more often than men and also enjoy a lower mortality rate in virtually all categories. Nathanson also concluded that because of their propensity to seek care sooner, women's experience of illness was less severe.[14]

5. Summary.

The most useful literature that addresses sex differentiated morbidity in a young adult population primarily arises from military medical research efforts. The comprehensive studies have usually addressed only admission rates on an entire system-wide basis. There is little discussion of experience in the outpatient arena. There were no studies that address ancillary services such as the laboratory, pharmacy and radiology. The guidance from the available literature indicates that there will be greater morbidity/workload associated with female recruits. Studies suggest that increased morbidity will be in the areas of orthopedics, psychiatry, genitourinary disorders and, of course, illness associated with pregnancy.

The project at hand will address both outpatient and inpatient aspects of the subject, including some examination of ancillary services.

Research Methodology

There are many aspects of this change in patient mix that must be considered: costs, space, supplies, utilities, manpower, etc. Prior to planning for these, it is preferable to assess the types of workload and morbidity changes that may result from training female recruits at Great Lakes. This project is designed to examine various aspects of male/female morbidity as part of a larger effort to plan for such a change in the patient population. Attention will be focused on four aspects of the medical system: 1) outpatient workload, 2) outpatient morbidity, 3) admissions, and 4) medical boards. This examination will be conducted in two phases. The first phase will involve comparison of male and female morbidity and workload at RTC Orlando, Florida in order to examine sex differentiations of a population exposed to the same environment and the same standard of medical practice. The second phase will use the results of that comparison to make projections about an integrated Great Lakes patient population.

1. Data Collection

a. The number of male recruits at Great Lakes and the number of males and females at Orlando was obtained from the official files of each RTC. The number that represents the population at risk for all official RTC attrition rate and other computations is called the "student flow". The student flow calculation allows for those who did not complete training to

be included in the formulation. Further discussion and the formulation of student flow is provided in Appendix A.

b. Fiscal year 1985 outpatient workload and morbidity information at RTC Great Lakes was obtained from official monthly outpatient morbidity reports at RTC Branch Clinic and the RTC Medical Inprocessing Clinic. Definition and explanation of the outpatient workload and morbidity categories is also provided in Appendix A.

c. The Naval Hospital Branch Clinic at RTC Orlando provided outpatient morbidity/workload data from their official reports. There are two sets of monthly reports: one each for male and female recruits.

d. Orlando male and female recruit inpatient data were obtained from Naval Medical Data Services Command, Bethesda, Maryland for FY 85. The Management Information Department at Naval Hospital, Great Lakes provided inpatient data for the same period from local computer records. The definitions of inpatient categories are included in Appendix A.

e. A Medical Board is a report by a panel of three physicians regarding their patient. It describes the diagosis, treatment, prognosis and administrative disposition of that patient. For recruits, a Medical Board will usually recommend separation from military service. Data regarding Medical Boards were obtained from official records at both Orlando and Great Lakes Naval Hospitals. Additional information about the categories of Medical Boards used in this project is in Appendix A.

2. Data Analysis

a. For the first phase, the data for male and female recruits at Orlando is organized into four major groups by categories as discussed in

Appendix A. Accompanying the appropriate total for FY 85, annual rates are calculated to allow direct comparison between the two sexes for that given diagnosis or work unit. A female to male ratio is also calculated to demonstrate the relationship between the two rates and to facilitate ranking the categories by degree of difference. Statistical analysis of most categories is made by application of the Chi-square (X^2) statistic. The hypotheses to be tested in each case are:

The H_0 : For category Z, there is no difference between the sexes for recruits.
The H_a : For category Z, there is a difference between the sexes for recruits.

2x2 contingency tables are constructed for each category using the annual workload/morbidity totals for males and females versus the total for the year. For example:

	Recruits Admitted	Recruits NOT Admitted
Male	XX	AAA
Female	YY	BBB

Formulas used in the application of X^2 and Z scores are discussed in Appendix B. A calculated X^2 statistic that exceeds the critical X^2 (1 degree of freedom at the 95% confidence level) of 3.84 will indicate rejection of the null hypothesis and acceptance of its alternate. This would indicate that there is a difference between the sexes in this category. Those areas that reflect the most difference by their calculated ratios will be ranked from greatest to least for discussion and analysis.

b. The second phase of analysis involves construction of a projected integrated patient population as well as projections of workload and

morbidity using the rates for Great Lakes male recruits and ratios from Orlando female recruits. The procedure for each subcategory is to reduce the FY 85 total by the number of units that 4,000 males would require at the calculated 1985 rate. The number of units that 4,000 females would use is then added to the remainder which yields the workload to be expected for the new integrated population. An example using X-ray exposures illustrates the procedure:

1) This hypothetical population for FY 85 is 40,000 males. X-ray exposures totaled 10,000 for the year which yields a rate of 250 exposures per 1000 male recruits per year. The calculated ratio for females from phase 1 was 1.20 which means that females "consumed" 1.2 times more x-rays than males.
2) At the above rates, 4,000 male recruits who are going elsewhere for training would have required 1,000 (250 x 4) exposures and 4,000 females who are replacing them would require 1,200 (1,000 x 1.2).
3) Therefore, when the expected male exposures are subtracted from the total and replaced by the expected female exposures, the result is a projection of x-ray exposures for the FY 87. 10,000 total FY 85 exposures - 1,000 male exposures + 1,200 projected female exposures = 10,200 exposures for mixed population.
4) The actual workload/morbidity figures can then be compared to the projections for statistical and practical significance in order to assess the nature of any change.

Footnotes

[1]Anne Hoiberg, "Health Care Needs of Women in the Navy," Military Medicine 144 (February 1979):104.

[2]Anne Hoiberg, "Sex and Occupational Differences in Hospitalization Rates among Navy Enlisted Personnel," Journal of Occupational Medicine 22 (October, 1980):686.

[3]Ibid., p. 689.

[4]Anne Hoiberg, "Health Status of Women in the U.S. Military," Health Psychology. 3 (3rd Qtr., 1984):278.

[5]Anne Hoiberg and P. J. Thomas, "The Economics of Sex Integration: An Update of Binkin and Bach," Defense Management Journal 18 (2nd Qtr., 1982):24.

[6]Dennis M. Kowal, "Nature and Causes of Injuries in Women Resulting from an Endurance Training Program," American Journal of Sports Medicine 8 (July-August 1980):266.

[7]R. R. Protzman, "Stress Fractures in Men and Women Undergoing Military Training," Journal of Bone Joint Surgery 59A (1977):825.

[8]Kent A. Reinker and Susan Ozburne, "A Comparison of Male and Female Orthopedic Pathology in Basic Training," Military Medicine 144 (August,1979): 533.

[9]Tracey J. Schmidt-Brudvig, Trina D. Gudher and Lee Obermeyer, "Stress Fractures in 295 Trainees: A One Year Study of Incidence as Related to Age, Sex, and Race," Military Medicine 148 (August 1983):667.

[10]Dennis M. Kowal, John F. Patton and James A. Vogel, "Psychological States and Aerobic Fitness of Male and Female Recruits Before and After Basic Training," Aviation Space Environmental Medicine 49 (April,1978):605.

[11]Marc A. Schuckit and E. K. Eric Gunderson, "Psychiatric Incidence Rates for Navy Women: Implications for an All Volunteer Force," Military Medicine 131 (July, 1974):534.

[12]James E. McCarroll, Dennis M. Kowal and Pamela W. Phair, "The Health Opinion Survey: Predicting Illness in Military Trainees," Military Medicine 146 (July, 1981):467.

[13]Constance A. Nathanson, "Illness and the Feminine Role: A Theoretical Review," Social Science and Medicine 9 (1975):59.

[14]Constance A. Nathanson, "Sex, Illness and Medical Care: A Review of Data, Theory and Method," Social Science and Medicine 11 (1977):18.

CHAPTER II

DISCUSSION

Phase One: Male vs. Female Recruits

Introduction

In order to discuss workload, morbidity and admissions at Naval Hospital, Orlando, Florida, it is useful to briefly examine the health care system that supports the Recruit Training Command at Orlando. The inpatient facility is a 5 year old, 162 bed facility that had 5,154 admissions in Fiscal Year 1985. It is organized to provide the same clinical and administrative services as Naval Hospital, Great Lakes, although on a slightly smaller scale.

Beginning in 1968, the Naval Hospital Branch Clinic at Orlando has been organized and staffed to support not only recruits, but also other staff and students that are stationed at Orlando. The clinic building is a three story facility that also houses a dental clinic and the Naval Hospital's Alcohol Rehabilitation Service. The Branch Medical Clinic's staffing is shown in Appendix C. Although there are separate clinics for recruits, it must be pointed out that personnel can easily be detailed among these clinics, as the situation dictates. Workload/morbidity reports are carefully separated so that medical care provided to recruits (both male and female) is not counted with other students.

At most Navy outpatient clinics, patients are screened by hospital corpsmen who perform triage. At Orlando, the site at which recruits are screened for medical care is based on an "In-Barracks Screening" Program. By this method, an independent duty hospital corpsman screens prospective patients in the barracks, prior to their reporting to the Branch Clinic.1 The goal of this program was not to affect workload or morbidity but to save recruits' training time by reducing trips to the clinic.

The population of recruits at Orlando for Fiscal Year 1985, in terms of student flow (Appendix A), was 29,446. Female recruits comprised 38% (11,166) of this population. This proportion fluctuated on a monthly basis from 36% (October) to 41% (May). The standard deviation of these monthly proportions is 1.4%, which indicates a relatively stable percentage of female recruits, with no extreme fluctuations. Appendix D contains an illustration of the monthly student flow of male and female recruits at RTC Orlando. This graph also shows that the male and female populations generally fluctuate together.

Outpatient Workload

The analysis of workload indicators does not necessarily provide accurate information about the incidence of disease. It is nonetheless useful to assess workload differences to determine the impact of a population change. In order from highest to lowest ratio of difference, selected outpatient workload indicators are shown in Table 1. More complete data and statistical information about these categories of outpatient workload for Fiscal Year 1985 are shown in Appendix E.

Only in the case of immunizations was the rate higher for males than females. It is policy at Orlando not to administer a live virus to a female who may be pregnant; therefore, some immunizations are deferred until pregnancy is ruled out. This accounts for the difference in the immunization rate.

TABLE 1

RECRUIT OUTPATIENT WORKLOAD BY SEX
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985

	Male	Female	Ratio
Flight Physical Exams.....	21.06	50.78	2.41***
Electrocardiograms.....	23.80	44.17	2.17***
Podiatry Visits.....	194.96	291.87	1.50***
Laboratory Procedures.....	6,850.20	8,484.78	1.24***
General Medicine Clinic....	1,716.58	2,008.96	1.17***
Glasses Fabricated.....	367.88	413.13	1.12***
Total Outpatient Visits....	2,970.16	3,318.83	1.12***
Pharmacy Units.....	4,674.60	5,091.71	1.09***
Total Physical Exams.....	54.92	58.03	1.06
Optometry Refractions.....	203.99	213.42	1.05
Optometry Clinic Visits....	1,065.18	1,093.59	1.03
X-ray Film Exposures.....	441.02	441.61	1.00
Immunizations.....	6,900.85	6,619.11	.96***

***p < .005

The statistical analyses required rejection of the null hypothesis (that there was no difference between sexes) in nine of the thirteen categories. The data indicates that there is no difference in the male and female rates for all physical exams, refractions, Optometry Clinic visits and X-ray exposures. It is interesting to note that the responsibility for performing these four functions on a new recruit is shared by the RTC's with Military Entrance Processing Stations (MEPS). The dual responsibility

for these functions clouds the usefulness of any explanations why these four workload measures are not different for males and females.

Although there is no difference for physical exams in general, when flight physicals are examined separately, a difference between the sexes becomes apparent. A ratio that is 2.4 times higher for female flight physicals can, in part, be attributed to the high proportion of females recruited to become air traffic controllers. There are special requirements for flight physicals that include: a flight surgeon, aviation medicine technicians, certified 20 foot eye lanes as well as other specialized requirements. Realizing the unique aspects of flight physicals, this difference between male and female recruits should not be taken lightly.

As a broad measurement of utilization, the rate at which female recruits sought outpatient care (Total Outpatient Visits) was 12% higher than the male rate. Among these, there were visits to Podiatry, Optometry and General Medicine Clinics. As the literature had indicated, the workload in the Podiatry Clinic was higher for females. The ratio for General Medicine Clinic visits, which makes up almost 60% of all visits, was higher than that of total visits. For every thousand female recruits, this represents almost 300 more visits to the clinic than for male recruits. Although the Optometry Clinic (as well as Refractions) showed no significant difference, the Opthalmic Support Unit was producing glasses at a higher rate for females. This is most likely because those females who require corrective lenses are more likely to report to training with contact lenses. Therefore, more replacement glasses must be made since they are not allowed to undergo training wearing contact lenses.2

The workload related to the performance of electrocardiograms (ECG's) was higher for female recruits. Even though they represent a smaller portion of the total recruit population, 114 more ECG's were administered to females than males. This amounts to a female rate more than double the male rate. While it must be acknowledged that this does not represent an incidence rate of cardiac disease, the Internist at the Orlando Branch Clinic suggested that higher incidence of mitral valve prolapse among females may account for much of the difference in ECG's.[3] Further discussion of the incidence of mitral valve prolapse will follow.

Among the ancillary departments, work units in the laboratory and pharmacy did show significant differences while X-ray exposures did not. A plausible explanation for a 24% higher rate of use of the laboratory includes the pregnancy tests conducted on female recruits. It is more difficult to attribute the greater use of pharmacy services to any specific type of illness except to point out that with 12% more total outpatient visits among female recruits, it is not unreasonable to see a similarly (9%) increased use of the pharmacy.

Outpatient Morbidity

The measurement of outpatient morbidity provides a more accurate perspective of incidence rates than workload measures. This is because the morbidity measurements for this project are comprised only of new cases. Table 2 shows morbidity categories ranked in order of prevalence for the aggregate of Orlando recruits as well as male and female recruits. Ranking the categories provides some perspective as to the relationship of the categories within their own gender group.

In Fiscal Year 1985, the most prevalent health problem for all recruits was respiratory disorders. It ranked first for males and second for females. The raw data showed over 11,000 new respiratory cases for the year which is 46% higher than the next category (musculoskeletal disorders). This does not come as a surprising finding when one considers the close living conditions and arduous activity schedule of recruit training, along with the general vulnerability of the respiratory system under stressful conditions.

TABLE 2

COMPARATIVE RANKINGS OF RECRUIT MORBIDITY RATES
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985

	ALL		MALE		FEMALE	
	Rate	Rank	Rate	Rank	Rate	Rank
Respiratory Disorders.....	379.10	1	416.95	1	317.12	2
Musculoskeletal Disorders...	258.47	2	265.75	4	410.26	1
Accidents/Injuries.....	225.84	3	264.98	2	161.74	4
Dermatologic Disorders.....	188.07	4	174.94	3	209.56	3
Infectious Disease.....	91.52	5	110.06	5	61.17	8
Genitourinary Disease.....	62.56	6	17.56	10	136.22	5
Digestive Disorders.....	54.34	7	35.28	6	85.53	7
Circulatory Disorders.....	35.86	8	30.58	7	44.51	9
Obstetric Related Disorders.	33.35	9	.00	13	87.95	6
Mental Disorders.....	23.70	10	23.80	9	23.55	10
Venereal Disease.....	21.80	11	27.95	8	11.73	11
Reactive Tuberculin Tests...	4.79	12	5.25	11	4.03	13
Endocrine Disorders.....	1.73	13	.27	12	4.12	12

Another expected finding is that both musculoskeletal disorders and accidents/injuries would be high in the rankings. The literature indicates that the physical stresses of training contribute to this expectation, i.e., stress fractures, strains, sprains, lacerations, falls, etc. In fact, when looking for the effects of physical stress, the examination

accidents combined with musculoskeletal disorders could shed some further light on the matter. When looked at together, the incidence of musculoskeletal disorders and accidents/injuries actually exceeds that of respiratory disorders which is the number one category.

Dermatologic disorders (acne, cellulitis, etc.) ranked third for both males and females. This may provide yet another indicator of the stresses of recruit training. Manifestations of skin problems in response to stressful situations is not at all uncommon, especially among a group of young adults in the 17-21 age range.

Although there is some variation among the three groups' rankings, it is interesting that the top four categories are the same for all three groups. These four categories (respiratory, musculoskeletal, accidents/injuries and dermatologic disorders) represent the vast majority of all cases in terms of incidence. Therefore, in a broad sense, it might be concluded that there is little notable difference between the groups. However, closer examination shows that differences do, in fact, exist.

Table 3 affords greater consideration of the differences between the incidence rates. Here the categories are placed in order from greatest to least female to male ratio. Those that have ratios greater than one indicate higher incidence rates among female recruits and those less than one show higher male incidence rates. Table 3 indicates that there are six categories where the female recruits have a higher rate of incidence; two categories that are neutral, and four where males have a higher incidence. When examined in this light, the four leading rates from Table 2 become split between females and males. The table in Appendix F provides some more detailed information. It should be noted that in all but two

categories (mental disorders and reactive tuberculin tests), the difference was found to be statistically significant.

Table 3

RECRUIT OUTPATIENT MORBIDITY RATES BY SEX
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985

CATEGORY	Male	Female	Ratio
Obstetric Related Disorders...	.00	87.95	N/A
Endocrine Disorders.....	.27	4.12	15.06***
Genitourinary Disease.....	17.56	136.22	7.76***
Musculoskeletal Disorders.....	165.75	410.26	2.48***
Digestive Disorders.....	35.28	85.53	2.42***
Circulatory Disorders.....	30.58	44.51	1.46***
Dermatologic Disorders.....	174.94	209.56	1.20***
Mental Disorders.....	23.80	23.55	.99
Reactive Tuberculin Tests.....	5.25	4.03	.77
Respiratory Disorders.....	416.95	317.12	.76***
Accidents/Injuries.....	264.98	161.74	.61***
Infectious Disease.....	110.06	61.17	.56***
Venereal Disease.....	27.95	11.73	.42***

***p < .005

The first two categories in Table 3 require some further consideration. Heading the table is the category for obstetric related disorders. There is obviously no comparison with males to be made for this category, but it is important to note that a raw average of 82 recruits per month reported problems in this area. These encounters can range from complications of a previous pregnancy to birth control counselling. Endocrine disorders appear to provide a major difference between the sexes with an incidence rate 15 times higher for females. Even though the population of recruits is large, the minute incidence rate based on only 5 cases for males could distort the comparison. If this is truly representative of the universe of recruits, the practical significance of

this low ranking category pales considering all endocrine cases amount to only four per month.

All five of the categories that follow reflect significantly higher rates for the female recruits. This comes as no surprise since previous research had indicated that along with the obstetrics related disorders, genitourinary problems should be expected to reflect a rather dramatic difference between the sexes. Earlier studies have suggested that there was a greater incidence of genitourinary, digestive and dermatological disorders among women in training. These studies cite the "vulnerability" of the female system and manifestations of stress as possible explanations for increased bladder infections, diarrhea, constipation, skin problems, etc. Circulatory disorders include heart murmurs, hemorrhoids and varicose veins.

Musculoskeletal disorders, which had the highest incidence rate for female recruits, include non-traumatic orthopedic conditions such as chronic low back pain, shoulder syndromes, muscle weakness and arthritic conditions. Trauma-related conditions are not included in musculoskeletal disorders. Trauma falls within the accident/injury category, where it is the male recruits who have a the higher rate. These accidents and injuries are primarily orthopedic in nature.

It is interesting to note that males lead in accidents/injuries and females lead in musculoskeletal disorders. It might have been expected that both of these orthopedic or "physical stress" categories would fall onto the same side of the gender equation. Appendix F contains four graphic comparisons of these two categories. Figures 3 and 4 show combined male and female rates for trauma and non-trauma cases. The non-trauma

cases exceed the trauma cases overall. Consistent with table 3, these two figures also show that males have more of the trauma and females more of the non-trauma disorders. Comparison of the two remaining figures (5 and 6) in Appendix F provide another perspective. Overall, females experience more incidence of the combined orthopedic categories, even though they lag behind in the trauma related problems. When combined, the rate for females is 572 per thousand versus the male rate which is 430 per thousand which amounts to a ratio of 1.32. The X^2 is 554.27 ($p > .005$). This dichotomy within the outpatient orthopedic area is consistent with previous Navy medical research findings.

It is possible that aspects of female physiology (less strength and stamina) may also account for some of the difference in the non-trauma orthopedic disorders.[4] Explanation of the higher male trauma-related disorders (accidents/injuries) is probably more than merely suggesting that males are more accident prone or females are more careful. It may lie in social science as well as in medical science. Nathanson has suggested that females are more likely to seek care early in the course of an illness because it is more consistent with their role in society. However, in the male role one is more likely to deny the illness, avoid treatment, take risks and even push beyond physical limitations and then become injured. Injury is a more socially acceptable condition for a male than illness.[5] The findings of this project that females have less injuries but seek more overall "orthopedic care" would support these theories about the role of females in illness.

The higher rates of venereal disease may also be consistent with some of the role theories. Male social behavior can certainly be a contributing

factor to a male rate that is more than twice that of females. On the other hand, it could also reflect that some venereal diseases are more difficult to diagnose in females and therefore are reported in other categories or not reported at all. It must also be noted that, unlike other infectious diseases, it is more likely that a venereal disease was contracted prior to arriving at recruit training rather than contracted after arrival. Despite any question as to the reason or cause for the higher rates, it is reasonable to expect that replacing females with males in a recruit population would result in lower rates for infectious and venereal diseases.

Respiratory disorders is another category that includes illnesses that are highly contagious such as upper respiratory infections (colds), laryngitis and influenza. A good reason to examine this category more closely is that it did have the highest overall incidence rate among all the categories. Figure 7 in Appendix F shows monthly rates in this category. There is a clear delineation between the sexes and the female rate is remarkably stable, especially after the first quarter. The male rate is more than 30% higher than that of females and about two thirds of the 11,163 cases were male recruits. This contradicts the findings of Hoiberg and others who found that females had a higher admission rate for this type of illness. It must be observed that these data are outpatient based and Hoiberg's data was for admissions. It is possible that females may be more likely to develop severe respiratory illnesses that result in admission to the hospital, whereas males predominate in the outpatient arena with less severe cases. This possibility cannot be confirmed or denied with existing data.

A category that the literature suggests would yield a higher female rate was mental disorders. As Table 3 shows, the annual rates for the incidence of mental disorders among male and female recruits at Orlando are virtually identical. A possible reason for the difference between these 1985 findings and the studies cited in the 1970's is that the Diagnostic and Statistical Manual of Mental Disorders, Second Edition (DSM-II) was revised in 1980 and republished as DSM-III. This revision is acknowledged as a very significant change in the way psychiatry is practiced and would certainly have an effect on the classification of these illnesses.6 Therefore, comparison of historical psychiatric studies to present data must take this into account. This administrative change is accompanied by advances in clinical psychiatry that allow many disorders to be treated differently, often on an outpatient basis. It is also important to consider that very little actual treatment of mental disorders is undertaken in recruit training. The psychiatry component of the recruit health care system is called the Recruit Evaluation Unit (REU). The primary function of REU is to screen (vice treat) for mental illness and personality disorders that would disqualify a person from continued military service. Treatment of a recruit, if indicated, is done on an inpatient basis or deferred until after training.

Admissions

There were 496 admissions of recruits at the Naval Hospital, Orlando, Florida in Fiscal Year 1985. Table 4 provides information regarding differing categories of admissions. Given the lower raw numbers, the admission rates are much lower than those from the outpatient sector. The

ratios are also much less striking for inpatients with no extremely (from two to seven times) higher rates in any of the categories. Statistical calculations indicate a significant difference between the sexes in overall admissions as well as in medical admissions (referred to as admissions in the Medical Directorate). Surgical admissions (or admission in the Surgical Directorate), with the obvious exception of gynecology, were not statistically significant.

Table 4

RECRUIT ADMISSION RATES BY SEX
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985

Category	Total	Ave/Mo	Rate	Ratio	X^2
ALL ADMISSIONS					
Male.....	282	23.50	15.43	1.24	5.85*
Female.....	214	17.83	19.17		
MEDICINE					
Male.....	198	16.50	10.83	1.31	7.82**
Female.....	159	13.25	14.24		
Psychiatry					
Male.....	77	6.42	4.21	1.62	9.02***
Female.....	76	6.33	6.81		
SURGERY					
Male.....	84	7.00	4.60	1.07	0.16
Female.....	55	4.58	4.93		
Orthopedics					
Male.....	30	2.50	1.64	.98	0.0036
Female.....	18	1.50	1.61		
Gynecology					
Male.....	0	.00	.00	N/A	29.48***
Female.....	18	1.50	1.61		

*p < .05
**p < .01
***p < .005

Figure 8 (Appendix G) shows that there is a general trend of higher female admission rates but there were periods when the male rate exceeded that of the females. The annual admission rates in Table 4 corroborates this observation. The fact that these rates fluctuate in terms of prominence is noteworthy since the annual female rate is significantly higher than the male rate. These fluctuations should temper any absolute conclusions to be made with regard to admissions.

Comparison of two principle Directorates, Medicine and Surgery, that contribute to the overall admission rate may shed more light on those fluctuations. Table 4 shows that the ratio of female to male admission rates is 1.31 for Medicine and only 1.07 for Surgery. Further, Appendix G contains two graphs of the monthly rates for these two categories (Figures 9 and 10). Surgery is quite volatile and no real trend can be seen. Medicine, on the other hand, is a more stable trend with a large peak in the summer and a secondary peak in the late winter. A part of the explanation may be due to the unpredictable nature of some illness or injuries treated in the Surgical Directorate i.e., general surgery, orthopedics, obstetrics/gynecology. A different year could yield remarkably different statistics. It appears that Surgery does contribute to the overall fluctuations seen in the overall admissions rates.

Psychiatry admissions are important because they comprise about 42% of all of the medicine admissions. The higher female rate in psychiatric admissions is in contrast to the outpatient data which indicated no difference in sex differentiated incidence rates for mental disorders. This may be attributed to the fact that the outpatient data is largely based on screening patients whereas the decision to treat as an inpatient

is based on a more thorough examination of the patient. Therefore, the difference found between males and females for psychiatry admissions should be more credible. The literature reviewed in Chapter I substantiates this view.

The opposite circumstance comes to light upon review of the orthopedic admission data. Although orthopedic admissions comprise more than one third of all surgical admissions, no significant difference between the sexes was apparent. Two "orthopedic" categories, musculoskeletal disorders and accidents/injuries, both revealed significant differences for outpatients. It is possible that since males were higher in accidents/injuries and females were higher in musculoskeletal disorders, that the two factors cancelled each other out when combined under one inpatient category. Records of outpatient morbidity do not take into account the severity of the condition, whereas an admission indicates a severe condition (at least more severe than outpatient). It is possible that those higher male and female outpatient rates comprise the less severe conditions.

Medical Boards

The incidence of medical boards done on recruits does provide an indication of cases on the severe end of the spectrum. However, these did not correlate with admissions since some medical boards are done on an outpatient basis. Medical boards are helpful in estimating medical attrition and classifying health problems that disqualify recruits from further service. Table 5 shows categories of medical boards with the rates and ratios for male and female recruits. Major totals and subtotals are in

capital letters. More information, including results of statistical analysis, is provided in Appendix H.

Table 5

MEDICAL BOARD RATE BY SEX AND SPECIALTY
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985

	Female	Male	Ratio
Psychiatry.....	1.07	.55	1.96
Opthalmology.....	1.79	1.20	1.49
Internal Medicine.....	10.12	8.37	1.21
MEDICAL DIRECTORATE.....	13.43	11.27	1.19
Dermatology.....	1.70	1.70	1.00
Podiatry.....	5.73	5.85	.98
TOTAL.....	38.60	45.56	.85***
Neurology.....	.54	.66	.82
SURGICAL DIRECTORATE.....	25.16	34.30	.73***
Orthopedic.....	14.60	22.26	.66***
Urology.....	.54	1.04	.52
Otorhinolaryngology.....	.81	1.86	.44*
General Surgery.....	.72	2.08	.34***
Gynecology.....	.99	.00	N/A

*p < .05
***p < .005

The total medical boards figure shows that medical boards are done more frequently for males than for females. This would indicate that, overall, males are more likely to have an ailment that is severe enough to require separation from military service. The two subtotals, medicine and surgery, fall on either side of the total rate. The medical board rate within the Medical Directorate contributes to a rise in the total, whereas the rate in the Surgical Directorate serves to pull the total rate down. This effect was also evident in the admissions data. Only three clinical departments have rates that are significantly different for medical boards. All three are from the Surgical Directorate, which is also statistically

significant and represents more than 70% of all medical boards. The ratios are less than one, therefore the significant difference in each of these cases favor the males.

There are three clinical departments that reflect higher rates for females. Psychiatry and Opthalmology are based on small numbers (less than four boards per month), but Internal Medicine's rates are based on 266 medical boards (more than 20 per month). Nonetheless, there were no categories with higher female rates that proved statistically significant. Medical boards for mitral valve prolapse is one area where female recruits do have a significantly higher rate than males. Mitral valve prolapse boards, which comprise one fourth of all Internal Medicine medical boards, were an area of focused study, at the suggestion of some of the Orlando Branch Clinic medical staff.

According to Harrison's Principles of Internal Medicine, mitral valve prolapse is a "common, but highly variable clinical syndrome resulting from pathogenic mechanisms of the mitral valve apparatus".6 It is most common among females ages 14-30 and is usually benign. It can progress to a stage where there is significant regurgitation and ventricular dilitation. Treatment is not indicated unless there are other clinical symptoms.

As seen in Table 13 (Appendix H), there were 1,264 medical boards on recruits, 833 for males and 431 for females. The rate for males was higher at 45.56 per thousand compared to 38.59 per thousand for females. Analysis of the difference between the two was significant ($X^2 = 8.19$; $p = .004$) in favor of the males. Internal Medicine boards represented 24% of all the boards done in 1985. The gap narrowed when looking only at Internal Medicine boards which yielded 153 male recruit medical boards, and 113

boards for females. This difference was not statistically significant ($X^2 = 2.37$; $p = .12$). Focusing attention to mitral valve prolapse medical boards alone, it is noted that there was a total of 64 medical boards with 27 for males, and 37 for females. Even though the numbers are quite small among a population of more than 29,000 recruits, the difference was significant ($X^2 = 10.78$; $p = .001$). This is an example of a significant difference that is deceptively hidden by aggregate totals.

In the area of psychiatry, although female recruits had a higher admission rate than males, it does not follow for medical boards, where no significant difference is seen. Despite the annual total of 153 admissions, only 22 medical boards were done for psychiatry. It would seem that there would be more medical boards, given that admission implies a serious condition and treatment in psychiatry typically takes a number of weeks. Part of the answer may lie in the administrative arena. Under the new diagnostic criteria in psychiatry, personality disorders are not considered a medically disqualifying defect. A person may be admitted for a personality disorder and subsequently separated administratively, rather than by medical board.

In the area of orthopedics, the male recruit rate for orthopedic medical boards was 52% higher than the female rate. This is despite admission rates which show no difference and outpatient morbidity rates (combined musculoskeletal disease and accident/injuries) that favor females. These data may not prove a trend, but there is a suggestion that females' orthopedic experience is less severe than males, even though care is sought more frequently.

Summary

In Phase One of this project, it was discovered that there are morbidity differences between male and female recruits at Orlando, Florida. Examination of general outpatient workload indicators revealed significant differences in many categories. Outpatient work assets were being directed to the female recruits at a greater rate in 11 out of 13 categories. In terms of outpatient morbidity, female recruits had significantly higher incidence rates in 7 of 13 categories, including two that were among the four highest volume categories. Differences are less pronounced with regard to the admission of recruits, although the overall admission rate for females was 24% higher than males. The male recruits had higher rates in most of the medical board categories. For medical boards, there were no categories where females' rates were significantly higher than males.

For Phase Two, the information gathered in the first phase will be used to help project the impact of female recruits on the same morbidity and workload measures at Naval Hospital, Great Lakes. In categories from this phase, where females receive a greater amount of care than males, it is expectable to find a similar effect on Great Lakes categories. Likewise, if females have lower rates of a given illness, it is reasonable to expect that the overall rate should decline when they join an all male population. In areas where the rates were not different, the workload and/or morbidity should remain stable.

Footnotes

[1]John R. Heltsley, "In-Barracks Screening: An Alternative Approach to Sick Call," U.S. Navy Medicine 73 (March 1982): 3-5. In order to provide

required supervision of screeners, this method was discontinued at Orlando on 01 October, 1985. Screening is now performed in the clinic. Great Lakes has been doing their screening in the clinic for a number of years.

[2]Interview with Commander E. J. Grout Jr., Medical Service Corps, United States Navy, Senior Optometrist, Branch Medical Clinic, Orlando, Florida, November, 1985.

[3]Interview with Commander R. Dy, Medical Corps, United States Navy, Senior Medical Officer, Female Sick Call, Branch Medical Clinic, Orlando, Florida, November, 1985.

[4]Dennis M. Kowal, John F. Patton and James A. Vogel, "Psychological States and Aerobic Fitness of Male and Female Recruits Before and After Basic Training," Aviation Space Environmental Medicine 49 (April 1978): 605.

[5]Constance A. Nathanson, "Illness and the Feminine Role: A Theoretical Review," Social Science and Medicine 9 (1975):61.

[6]Jerrold M. Maxman, The New Psychiatry, (New York: William Morrow and Company Inc., 1985) p. 35.

[7]Robert G. Petersdorf, Raymond D. Adams, Eugene Braunwald, Kurt J. Isselbacher, Joseph B. Martin and Jean D. Wilson, Eds., Harrison's Principles of Internal Medicine, Vol 2, 10th Ed., (New York: McGraw-Hill Book Company, 1983) p. 1409.

CHAPTER III

DISCUSSION

Phase Two: Projections for Great Lakes

Introduction

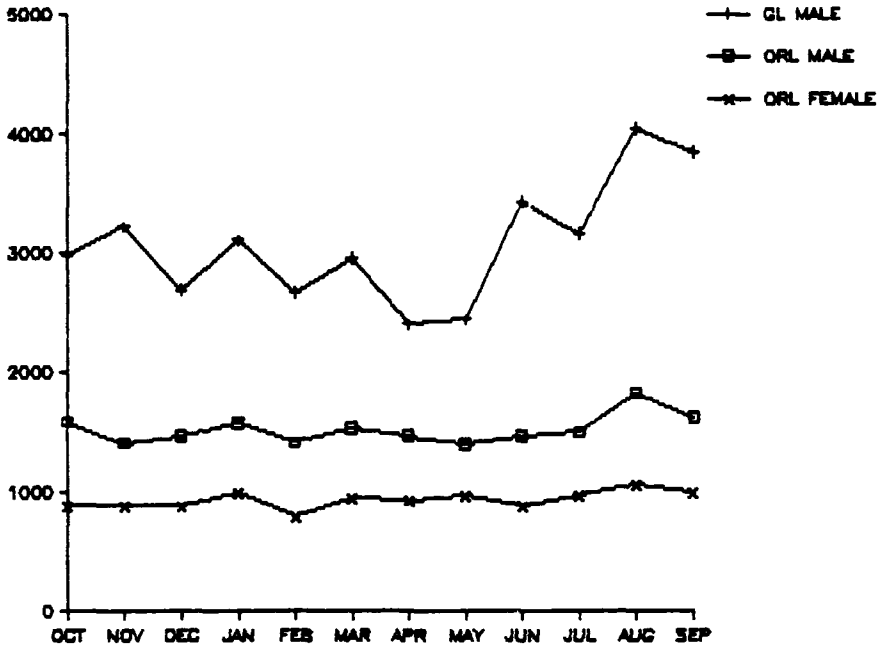
As previously noted, this project assumes a population that would change from 36,912 all male recruits to one that is still 36,912, but with 4,000 females and 32,912 males. This amounts to a 10.8% female population at Great Lakes, as opposed to a 38% female population (11,166 females/18,280 males) at Orlando. Since the percentage of females at Great Lakes will be much smaller, the impact of females upon projections will be less pronounced than at Orlando. Therefore, it is expected that the differences discovered in Phase One will have less effect on the actual workload and morbidity totals since females are a smaller part of this projected population.

In Chapter II, ratios were used to assist in a comparison of female and male differences in rates. In this Chapter, ratios will also be used, but not to compare males and females. The ratios found in this Chapter will differentiate between the FY 1985 workload/morbidity data and the projected workload/morbidity for FY 1987. Therefore, when the ratio is greater than one, the workload/morbidity is higher for the projected male/female population than the present, all male, population. Conversely,

if the ratio is less than one, the all male population is the higher of the two.

Figure 1

STUDENT FLOW COMPARISON
RTC Orlando and RTC Great Lakes
Recruits per Month - FY 1985



A comparison of the actual recruit populations shows that RTC Great Lakes receives all of the Navy's recruit "overflow" or recruits in excess of recruiters' plans. This has an effect of greater variability from month to month with a large peak in the summer months. The standard deviation of the monthly student flow for FY 1985 at Orlando was 170 (mean: 2,454) whereas it was 492 (mean: 3,076) at Great Lakes. Figure 1 is a graphic representation of this phenomenon. When compared to the Great Lakes student flow, Orlando appears quite stable. An epidemiological consideration of this "overflow" situation is that with more recruits in

close quarters, the spread of infectious diseases can be more extensive than with the smaller population. From time to time, epidemics do occur in recruit training and they are often unpredictable. The relative impact of epidemics on these populations, and the subsequent projections, is not readily known.

A prerequisite to an adequate discussion of projections of workload and morbidity includes a review of the circumstances under which health care is provided at the RTC Branch Clinic, Great Lakes. Unlike its sister facility at Orlando which serves recruits and other student personnel, the Great Lakes clinic serves recruits only. It is located on a segregated RTC compound which has limited access. This contrasts with Orlando where the clinic director, if the situation dictates, can pull staff from one clinic to another more readily, since all clinics are in the same building. Great Lakes and Orlando each have another separate clinic, the RTC Medical Inprocessing Clinic, where recruits are seen for their initial medical screening prior to commencement of training. This clinic provides eye exams, immunizations, blood tests and other inprocessing-related medical functions.

The services offered by the personnel at Great Lakes vary only slightly from those at Orlando (See Appendix C). In terms of overall numbers of personnel, Great Lakes appears more lean than Orlando, especially when the higher volume of patients seen at Great Lakes is added for consideration. Since some of Orlando's departments serve both recruits and non-recruits, direct comparison of the staffing listed in Table 10 may be deceptive. In addition, more staff is obviously necessary to run two

recruit clinics (male and female). It is also necessary to have standby personnel for certain examinations of female patients. Of note is the Recruit Evaluation Unit which is staffed with more neuropsychiatric technicians at Great Lakes. The result is more thorough screening at the REU with less referrals to the hospital psychiatry clinic. A staffing study that takes these factors and the workload projections into account could be one of the consequences of this project.

Workload Projections

Table 6 provides an overview of projected workload for the hypothetical integrated recruit population. More detail is provided by Table 14 in Appendix I, including the projected female workload, the annual and monthly difference from the all male population, and the results of statistical analysis.

Sex differentiated ratios were an important part of the calculations of the projected workload indicators. Therefore, the ranking of projected ratios will remain in the same order as the Fiscal Year 1985 information. However, as expected, the degree of difference is less. For example, in Phase One, the ratio of female to male flight physicals was 2.4 to 1, but the net ratio for Great Lakes is only 1.15 to 1.

Flight physicals provide the largest difference from the all male population. The flight surgeon necessary to perform this type of exam for Great Lakes recruits is at the Branch Clinic at Naval Air Station, Glenview Illinois, which is 20 miles from RTC. Glenview currently maintains a delicate balance of performing recruit flight physicals in addition to those for pilots and others stationed at Glenview. Any increase, including

one of only 5 per month, will have an adverse impact upon this facility.1 There may also be impacts considering that 22% of all recruit flight physicals would be for females.

Table 6

PROJECTED RECRUIT WORKLOAD
Naval Hospital Great Lakes IL
Total Work Units for FY 1987

	FY 85	Projected	Difference	Ratio
Flight Physicals.....	371	426	55*	1.15
Electrocardiograms.....	571	636	65	1.11
Podiatry Clinic.....	14,025	14,780	755***	1.05
Laboratory Procedures.....	117,955	121,003	3,048***	1.03
General Practice Clinic....	182,034	185,392	3,358*	1.02
Glasses Fabricated.....	12,278	12,441	163	1.01
Outpatient Visits.....	273,170	276,643	3,473	1.01
Pharmacy Units.....	167,546	169,164	1,618	1.01
All Physical Exams.....	14,313	14,399	86	1.01
Optometry Refractions.....	7,087	7,122	35	1.00
Optometry Clinic.....	53,499	53,652	153	1.00
X-ray Film Exposures.....	41,078	41,083	5	1.00
Immunizations.....	332,433	330,960	-1,473	1.00

*p < .05
***p < .005

With regard to electrocardiograms, the increase approached but did not achieve statistical significance ($p = .06$). This is another case where an increase of 5 per month appears small, however, as much as 20% of the projected total ECG's will be for females. This patient mix may require adjustments in facilities for privacy and staffing for standby's during the procedure.

The podiatry clinic's projections are the first area where a large amount of workload appears to be involved. There is an increase in clinic visits of 755 patients. According to projections, this amounts to an

increase of more than 5% in the overall workload, including 15.4% of the visits to be made by female recruits. The literature which suggests greater incidence of stress fractures and other foot problems does substantiate these findings. The ability of the present staff to absorb this additional workload would have to be studied.

The main contingent of primary medical care is provided at "military sick call" which is classified as general practice in Table 6. Analysis shows a statistically significant difference between the current and projected population. Approximately 12.5% of all visits would be made by female recruits. This is larger than the 10.8% proportion that females would represent in the total recruit population. Due to the high volume of visits at this clinic, the projected number of female visits is in the neighborhood of 23,000 (an average of 1,916 per month). The monthly increase that is expected is about 280 visits. Military sick call is an area of great practical significance, not only because of the high numbers, but because of the variety of illness that will comprise these visits.[2] The next section which addresses outpatient morbidity may provide more insight about the nature of these sick call visits.

The three areas related to optometry are total optometry clinic visits, glasses fabricated and refractions. None of the projected changes in these categories amounted to statistically significant changes. The optometrists who perform this function at Great Lakes saw no practical significance or implications regarding this change.[3]

There are also some implications for some of the ancillary departments. Most of the difference in the laboratory would be made up of increased pregnancy tests and bacteriological tests (urine cultures), which

may present some shortfalls in technicians even though the necessary equipment is currently available at the hospital's main laboratory.[4] The small branch laboratory at RTC Branch Clinic does not have all of the resources for these tests. The specimens would have to be sent to the main laboratory at the Naval Hospital, with the inherent logistical problems of transporting specimens. As for pharmacy, there will be a one-time impact of stocking the RTC clinic pharmacy with vaginal creams, birth control pills, etc. Afterwards, the impact of the additional 135 prescriptions per month was considered negligible.[5] A similar conclusion was reached regarding radiology, except that some consideration would have to be given to the need for a female dressing room in the RTC clinic X-ray department, but actual impact on workload is also negligible.[6]

Morbidity Projections

Examination of Table 7 indicates that the categories are, again, in the same rank order but the degree of difference is reduced. Appendix I, Table 15 contains a greater degree of detail for the discussion of these outpatient morbidity projections. It must be remembered that these morbidity figures measure the new cases only. When follow-up appointments, recalls, suture removals, etc., are included, the actual number of clinic visits will be greater.

The first five categories reflect statistical significance in the direction of increased incidence of morbidity. There are two other statistically significant categories, respiratory disorders and accidents/injuries, which show reduced incidence in the projected population.

The obstetric related disorders show the highest X^2 because, obviously, there was no morbidity at all in this category in the all male population. A factor that tends to weaken the practical significance given this category is that fully three fourths of the cases in this category merely require management of birth control medications. The other fourth would involve an actual past or present pregnancy.

Table 7

PROJECTED RECRUIT MORBIDITY
Naval Hospital Great Lakes IL
New Cases for FY 1987

	FY 85	Projected	Difference	Ratio
Obstetric Related Disorders...	0	351	351***	N/A
Endocrine Disorders.....	14	34	20***	2.43
Genitourinary Disorders.....	376	651	275***	1.73
Musculoskeletal Disorders.....	7,582	8,793	1,211***	1.16
Digestive Disorders.....	923	1,064	141**	1.15
Circulatory Disorders.....	510	534	24	1.05
Dermatology Disorders.....	4,012	4,097	85	1.02
Mental Disorders.....	87	86	-1	.99
Respiratory Disorders.....	12,968	12,630	-338**	.97
Reactive Tuberculin Tests.....	205	199	-6	.97
Accidents/Injuries.....	6,983	6,687	-296**	.96
Infective Disease.....	2,894	2,754	-140	.95
Venereal Disease.....	443	414	-29	.93

**p < .01
***p < .005

The other category readily associated with females is genitourinary disorders. Disorders of this type do occur with males but the examination, diagnosis and treatment of females have unique implications. The female recruits at Orlando had more than seven times the incidence of these types of problems than the males and this is reflected in the projections by a ratio of 1.73 favoring higher incidence in the integrated population at

Great Lakes. According to projection, the female recruits, although only 11% of the population, will comprise almost half of the genitourinary cases seen at RTC Great Lakes.

The implications to consider for this difference include facility design for privacy of exams, standby's for male practitioners, gynecological medications, equipment and supplies, as well as training of staff in the recognition and treatment of these disorders, to mention a few. This area is usually the first to arise upon discussion of this project with military health professionals. The information from the table helps focus in on planning for about 300 additional cases of genitourinary disorders.

The most notable change in terms of volume and statistical significance concerns musculoskeletal disorders. A jump of more than one hundred new cases per month can have a multitude of practical implications for the clinic. These implications range from use of more pain/muscle relaxing medications, loss of training time for injured recruits, prescription for crutches, braces, etc. In fact, it is likely that consults with the main hospital orthopedic staff may also increase. There was a decrease on the part of its "sister" category, accidents/injuries. This decrease might have offset the large increase in overall orthopedic cases, but there was not a very substantial overall reduction. There will still be about 900 new musculoskeletal disorder cases annually. The general practice clinic will see the majority of these cases, but podiatry might also expect to see some of them as a part of their projected visit increase.

The two remaining categories that indicate statistically significant increases are the endocrine and digestive disorders. The practical significance, however, of only two additional endocrine disorders per month is not very impressive compared to more than 15,000 general practice clinic visits each month. Digestive disorders, at 12 more cases per month, were also considered unimpressive in practical terms. Further, the diagnosis and treatment of common digestive disorders (diarrhea, constipation, etc.) do not vary by sex.

The two categories which show statistically significant decreases are accidents/injuries and respiratory disorders. The implications of reduced accidents and injuries include a better command safety record and possibly fewer visits after hours. Again, the size of this reduction is not very important, in practical terms. Respiratory disorders are an important category at Great Lakes, especially during the cold and influenza season. The projections show a decreasing ratio of .97 for new respiratory cases, which amounts to about 300 fewer cases over the course of a year. It is of practical importance for the clinic to know what this reduction will amount to during the peak season. Given the variability of spread patterns of these diseases and of the recruit population itself at Great Lakes, it is difficult to project the effect of this reduction on a seasonal basis. The seasonal variations of recruit morbidity pose very suitable questions for further research efforts.

Admission Projections

As the information in Table 8 indicates, there are no statistically significant changes in projected admissions with an integrated population

of recruits. Table 16 (Appendix I) adds some detail to this observation, including very low scores in the X^2 analysis. Naval Hospital, Great Lakes admitted 7,782 patients during FY 1985. The projected increase of 16 more admissions amounts to only a 0.2% change.

Table 8

PROJECTED RECRUIT ADMISSIONS
Naval Hospital Great Lakes IL
FY 1987

	FY 85	Projected	Difference	Ratio
ALL ADMISSIONS.....	596	612	16	1.03
MEDICAL DIRECTORATE.....	397	411	14	1.03
Psychiatry.....	113	121	8	1.07
SURGICAL DIRECTORATE.....	199	201	2	1.01
Orthopedics.....	81	81	0	1.00
Gynecology.....	0	6	6	N/A

Given that bed space has not been an issue in the recent past for Naval Hospital, Great Lakes, it is doubtful that any effort to change existing operations would be warranted.7 There is a chance that space on wards for females could become an issue if many female recruits are admitted at the same time. However, the average number of females per month is projected to be about seven patients.

The data suggests that there should be no concern about admission changes in the aggregate. However, one specific area of particular concern is the locked ward of the Psychiatry Department. It has accommodations for only four female patients. If the census exceeds four, any subsequent admissions would have to be transferred to another facility. The information in Table 16 indicates that 20 of the projected psychiatric

admissions would be female recruits. The Head of the Psychiatry Department, upon review of the projections, has determined that this amount would place then at their capacity, but not over capacity.[8] It is possible that occasional fluctuations in these female psychiatric admissions would make transfer necessary, but the overall impact seems to fall within the capability of the Psychiatry Department.

The lack of significant differences in the area of admissions may be surprising. It appears to contradict the findings of other research cited in the literature review. It must be remembered that Phase One did discover differences between male and female recruit admission rates. Phase two merely compares present to projected Great Lakes data. Therefore, in fact, there is not a contradiction. Phase two data, discussion and conclusions are not constructed for comparison. The most relevant observation as to the reason for the lack of significance stems from the fact that the raw numbers are quite small in comparison to present and projected populations of almost 37,000. Of course, this is taken into account in the normal course of X^2 calculation and significance is not very easy to achieve.

Medical Board Projections

Changes in the number of medical boards undertaken will affect two particular areas: 1) Hospital and Branch Clinic medical board clerks and counsellors who type and process the boards, and 2) the specific departments conducting the boards. Table 9 shows an overview of the projected changes in medical boards. In Appendix I, Table 17 allows more

detailed examination of the data. As with admissions, none of differences in the categories or subcategories achieved statistical significance.

Table 9

PROJECTED RECRUIT MEDICAL BOARDS
Naval Hospital Great Lakes IL
FY 1987

	FY 85	Projected	Difference	Ratio
ALL MEDICAL BOARDS.....	1362	1,363	1	1.00
SURGICAL DIRECTORATE.....	769	748	-21	.97
General Surgery.....	25	23	-2	.93
Gynecology.....	0	4	4	N/A
Opthalmology.....	69	73	4	1.05
Orthopedics.....	469	451	-18	.96
Otorhinolaryngology.....	113	106	-7	.94
Podiatry.....	57	57	0	1.00
Urology.....	36	34	-2	.95
MEDICAL DIRECTORATE.....	593	615	22	1.04
Dermatology.....	49	49	0	1.00
Internal Medicine.....	272	278	6	1.02
Neurology.....	103	101	-2	.98
Psychiatry.....	169	187	18	1.10

The total medical board category indicates a projection of virtually no change in medical boards. There are some changes when the two Directorates are examined. The Surgical Directorate decreases by 21 and the Medical Directorate increase by 22, thereby cancelling each other out in terms of the total. The Orthopedic Department accounts for the majority of the surgical decrease. Psychiatry accounts for the increase in Medicine. Neither Orthopedics nor Psychiatry are concerned with the practical significance of these changes. Given no increase in the admissions categories, it is possible that many of these boards will be done on outpatients. In any case, since increases are counterbalanced with

decreases, there is no significant impact upon the clerical or counselling personnel who work on medical boards.[9]

Footnotes

[1]Interview with Lieutenant K. K. Senn, Medical Service Corps, United States Navy, Officer in Charge, Naval Hospital Branch Clinic, Glenview, Illinois, April, 1986.

[2]Interview with Commander C. J. Corrall, Medical Corps, United States Naval Reserve, Senior Medical Officer, RTC Branch Clinic, Great Lakes, Illinois, April, 1986.

[3]Interview with Commander J. A. Beil, Medical Service Corps, United States Navy, Senior Optometrist, RTC Inprocessing Clinic, Great Lakes, Illinois, April, 1986.

[4]Interview with Lieutenant Commander C. W. Locke Jr., Medical Service Corps, United States Navy, Laboratory Officer, Naval Hospital, Great Lakes, Illinois, April, 1986.

[5]Interview with Commander T. K. Shea, Medical Service Corps, United States Navy, Head, Pharmacy Department, Naval Hospital, Great Lakes, Illinois, April, 1986.

[6]Interview with Lieutenant Commander E. M. Smorzaniuk, Medical Corps, United States Naval Reserve, Head, Radiology Department, Naval Hospital, Great Lakes, Illinois, April, 1986.

[7]Interview with Commander E. E. Snyder, Nurse Corps, United States Navy, Assistant Director, Nursing Service, Naval Hospital, Great Lakes, Illinois, April, 1986.

[8]Interview with Captain J. R. Driver, Medical Corps, United States Naval Reserve, Head, Psychiatry Department, Naval Hospital, Great Lakes, Illinois, April, 1986.

[9]Interview with Lieutenant C. W. Olson, Medical Service Corps, United States Navy, Head, Patient Administration Department, Naval Hospital, Great Lakes, Illinois, April 1986.

CHAPTER IV

CONCLUSION

Summary

During this two-phase project, comparisons and projections were made about male and female recruits in order to plan for a proposed change in the mix of recruits at Recruit Training Command, Great Lakes IL. Areas of examination were outpatient workload, outpatient morbidity, admissions and medical boards.

Phase One of the project dealt with the more empirical aspects of the problem. Previous research efforts concentrated on admission rates and some study of outpatient morbidity. These previous studies have suggested that, as outpatients, females would experience greater incidence of orthopedic, respiratory, psychiatric, digestive and genitourinary disorders. The findings of this project are in agreement with the others for orthopedic, digestive and genitourinary disorders. However, no difference was detected for mental disorders. Respiratory disorders actually occurred less often in females.

Admission data did show a higher rate of total admissions. Furthermore, a higher rate of admission for female recruit psychiatry patients was evident. Outpatient workload indicators showed higher rates for females in all categories, except immunizations. Medical board rates

were, on the whole, higher for female recruits with most of the difference in the surgical specialties.

A trend in the area of orthopedics was evident. The trend followed along a continuum of medical care from outpatient (primary) care, continuing with hospital admission, and finally to discharge from the military service by medical board. It appears that females, with higher outpatient orthopedic rates, receive more care at the primary, outpatient level. Furthermore, males are more likely to have injuries whereas females seek care for non-traumatic orthopedic care. Upon admission, the difference evens out and, finally, it is the males who are more likely to be medically boarded out of the service because of a disqualifying defect. Establishment of a cause and effect relationship along this continuum is not within the scope of this project, but it appears to be a rich area for further research.

Phase Two used the discovered differences to provide usable planning information. Projections of differences between the all male and the planned male/female population in Phase Two were less impressive than the differences which surfaced in Phase One. This was largely due to the smaller size of the female contingent in the projected population. The only differences that surfaced were in the outpatient arena. Significant increases in workload were projected for flight physicals, the podiatry clinic, the laboratory and military sick call. Other projected workload increases were not deemed significant, in practical terms, by knowledgeable Great Lakes professionals.

Outpatient morbidity projections should give some indications about which clinical areas of military sick call may expect change. Morbidity

data pointed to considerable increases in obstetric related, genitourinary, musculoskeletal and digestive disorders. Accidents/injuries and respiratory disorders were projected to decrease in the proposed integrated population. Based on these projections, areas where an impact is expected may be targeted for specific planning efforts.

General Observations

There are a number of areas where it would be appropriate to continue with examination and planning for this change in patient mix. This project has served to focus planning efforts to more specific areas and effectively rule out areas where no further concentrated effort would be required. It is just as important to be aware of the areas that ought not expect changes as the ones that will be affected. This section will address the general areas where no further work seems necessary to be followed by specific recommendations where further attention is needed.

Based on the projections made for an integrated Great Lakes recruit population, there is little need to be concerned about impact on the Naval Hospital's inpatient health care system. The total change will be miniscule in comparison to present admission levels. The additional workload projected for the female patient wards is little more than a handful of patients, during an average month. In fact, the male wards will see about 60 fewer admissions each year.

Medical board workload will also be unaffected. This is particularly true for the Patient Administration clerical and counselling personnel who support this function. There is an increase in the number of psychiatric medical boards projected, but it amounts to only 1 or 2 per month, which is

of little practical significance. The medical board workload of other clinical departments should remain virtually unchanged, or, as in the case with orthopedic medical boards, should be reduced. General Practitioners and Internal Medicine staff should be aware of the higher incidence of mitral valve prolapse as a disqualifying condition among female recruits.

Projections indicate that Radiology is another department which should expect virtually no change in workload. This is also true for Optometry, including the Optical Fabrication Unit. Pharmacy's increase in prescriptions was considered so slight that it could be absorbed, after initial stocking of some female specific preparations. The laboratory's increase in procedures may be within tolerable limits. They may require one additional tube of blood to be drawn on females by the inprocessing personnel.

The locus of change will be in the outpatient arena, concentrating in podiatry, flight physicals and military sick call. These three areas appear to warrant the most attention for future planning. There are a myriad of considerations to take into account for these outpatient functions. The narrowing of so many categories down to three should not imply that the remaining planning will be simple. The fact is that military sick call is the cornerstone of health care support provided to all recruits. Changes affecting military sick call will easily have far reaching implications.

Specific Recommendations

Recommendation 1: Staffing at RTC Branch Clinic

Now that the nature of the workload can be more clearly identified, a staffing study should be conducted to determine the proper amount of staff, concentrating on the gender makeup of the staff, to accommodate approximately 2,000 female patients at military sick call per month (as per Appendix I, Table 14). The majority of patients will be reporting to military sick call, but podiatry will also see some, given a propensity to stress fractures and other orthopedic problems. Table 2 provided a rank order list of the cases that may be expected at military sick call.

It is understood that no personnel increases is a given limitation for this project. However, if the staffing study determines the need for additional female providers or hospital corpsmen, it may be necessary to exchange some personnel with other departments in order to meet this need.

Recommendation 2: RTC Branch Clinic Facilities Utilization

The accommodation of female patients will require designation of spaces in the clinic where there can be reasonable privacy for examinations. The location of examination rooms, dressing rooms, lavatory facilities, etc., will have to be designated. At Orlando, spaces are committed solely for the use of female recruit sick call. With the forecasted numbers for Great Lakes, it is entirely possible that female sick call will not require an entire complement of clinical spaces (or staff) for an entire day. With existing constraints on space and staffing, flexible approaches to utilization of space and personnel may prove useful.

Recommendation 3: Flight Physical Examination Procedures

With an increase in flight physicals to be performed at the Branch Clinic at Naval Air Station, Glenview, Illinois, it would be worthwhile to review the current procedure of sending bus loads of recruits to the flight surgeon. A comprehensive study of the provision of flight physicals will have to consider many facets of this support function. It may be more cost effective to bring the flight surgeon to Great Lakes for the necessary time. Another alternative would be to convert a current position at Great Lakes to a flight surgeon in order to meet this requirement. In addition to flight surgeon staffing, consideration must be given to support personnel, i.e., aviation medicine technicians. Since there are specific space requirements necessary for these examinations, this recommended review should include consideration of the location for flight physicals. The RTC Inprocessing Clinic is a possible site because it does have the required 20 foot eye lanes.

Recommendation 4: Laboratory Staffing.

The additional workload in pregnancy tests coupled with more tests ordered due to the increase in genitourinary and digestive disorders should be assessed to make sure that the additional tests may be adequately absorbed by existing staff at the RTC Branch Clinic laboratory. It may be necessary for the main hospital laboratory to send additional personnel on certain days, such as female inprocessing days.

Recommendation 5: Laboratory Equipment

As previously mentioned, regulations require pregnancy tests to be performed on all female recruits prior to administration of live viruses.

Currently, the only equipment available for this test is at the main hospital. Performing these tests at RTC should afford minimum turn-around time. It would be useful to consider procurement of the necessary equipment for the RTC laboratory to conduct these tests.

Recommendation 6: Recruit Inprocessing Procedures

At present, companies of recruits are processed in whatever sequence they arrive. On many days, this requires processing three companies (75 recruits each) simultaneously. One or two female companies per week will have to be inprocessed in such a way as to not interfere with efficiency, yet allow privacy where necessary. This may only be a matter of timing the arrival of companies more carefully, such that only the female company would be at the inprocessing clinic on a given afternoon, for example.

Recommendation 7: RTC Clinic Staff Training

Based on differences in morbidity, conduct staff training prior to arrival of female recruits. Alert enlisted screener personnel and other paraprofessionals of the likely differences in illness that will be encountered. These morbidity differences from an all male patient population include:

1. Increase in genitourinary disorders
2. More overall musculoskeletal disorders (fewer from injuries)
3. Greater incidence of digestive, circulatory and dermatologic disorders
4. Reduced likelihood of respiratory illness
5. Fewer venereal and other infective diseases

While it is useful to understand that these will be the trends that can be observed over a period of time, it must not be considered as an absolute for each patient. It does not mean that no women will contract venereal disease. On the other hand, an increased vigilance for such conditions as mitral valve prolapse is appropriate.

Epilogue

Based on numerous interviews and discussions about the topic of integrating male and female recruits at RTC Great Lakes, it might have been easy to conclude that the change was going to be overwhelming and that massive adaptation of the present system would be indicated. The data would not appear to support this alarmist position. While it is true that some important staffing and facility questions must be addressed, it does not appear that extreme solutions such as doubling the present staff or the building of a new clinic will be necessary. From the viewpoint of the medical community, the differences between male and female recruit maladies are identifiable and it is possible to make objective plans to cope with the change.

APPENDIX A

DEFINITIONS

1. STUDENT FLOW

The "Student Flow" is the standard used when addressing the number of recruits that have been processed for a given time period. It is designed to take into account accession, graduation and attrition for workload reporting and official attrition rate calculation. The formula used for calculation of student flow during a given (month or year) time period is:

$$\frac{\text{Total Accessions} + \text{Total Graduates} + \text{Total Attritees}}{2}$$

For Fiscal Year 1985, the annual student flow used for this project at the respective training sites was:

Orlando (Males):	18,280 recruits
Orlando (Females):	11,166 recruits
Great Lakes (Males):	36,912 recruits

2. OUTPATIENT WORKLOAD CATEGORIES

The categories used for the measure of outpatient workload were taken from the Medical Services and Outpatient Morbidity Report (NAVMED 6300/1). The source for all definitions of workload units and weights is Naval Medical Command Instruction 6300.2A. The thirteen outpatient workload categories used for this project are:

1. Total Outpatient Visits*
2. General Practice Clinic Visits*
3. Podiatry Clinic Visits*
4. Optometry Clinic Visits*
5. Laboratory Procedures (Weighted)*
6. Electrocardiograms
7. Pharmacy Units*
8. X-ray Film Exposures*
9. Refractions (By Optometrist)
10. Single Vision Spectacles Fabricated
11. Flight Physical Examinations
12. Total Physical Examinations
13. Immunizations*

* X^2 statistic is not used for these categories. A test of the difference between two proportions is substituted. A more detailed discussion is contained in Appendix B.

3. OUTPATIENT MORBIDITY CATEGORIES

The source of definitions and selection criteria applied to the above workload categories was also used for the morbidity categories. The source documents provide information concerning both initial and follow-up visits in the morbidity categories. For the computation of incidence rates, only the new cases were used in this project. There is not total morbidity classification. The thirteen categories measuring morbidity are:

1. Infective Diseases: Includes acute gastroenteritis, diarrhea, venereal diseases, fungal diseases, etc.
2. Venereal Disease: subset of Infective Disease
3. Endocrine Disease: includes nutritional and metabolic disorders
4. Mental Disorders:includes drug/alcohol disorders as well as psychoses, neuroses and personality disorders
5. Circulatory Disorders: heart, vascular and blood diseases
6. Respiratory Disorders: lung disease, throat infections, influenza, pneumonia and many allergies
7. Digestive Disorders: ulcer, constipation, hepatitis, hernias and indigestion
8. Genitourinary Disease: bladder infections, menstrual dysfunction, hematuria, etc.
9. Obstetric Related Disorders: complications of pregnancy, childbirth and birth control)
10. Dermatologic Disorders: cellulitis, dermatitis, rashes, warts, hives, etc.
11. Musculoskeletal Disorders (non-traumatic): arthritis, joint disorders, muscle weakness, foot disorders, chronic low back pain, recurrent dislocations, etc.
12. Accidents/Injuries: trauma, training accidents, etc.
13. Reactive Tuberculin Tests

It is noteworthy that these categories do not differentiate the severity of an illness or whether it resulted in admission to hospital. Therefore, it is possible that indigestion is counted in the same class with appendicitis. There are some categories that exist but flaws in data recording or simply lack of sufficient data precluded their use in this project:

1. Nervous Disease (sensory and neurologic in nature): This category was not usable because data was flawed. Records indicated that Orlando counted such things as optometry visits as nervous disease whereas Great Lakes did not. Their rates in this category differed by a factor of 30 (1,037 per thousand at Orlando and 35 per thousand at Great Lakes for males).
2. Neoplasms: insufficient data
3. Congenital Anomalies: insufficient data
4. Signs, Symptoms and Ill-Defined Conditions: A sort of miscellaneous category that includes fatigue, headache, fevers of unknown origin and "all others". Due to the vagueness and subjectivity of criteria in this category, it was deemed of little practical use for this project.

4. ADMISSION CATEGORIES

Definitions, reporting criteria, etc., for inpatient data is governed by Naval Medical Command Instruction 6300.2B regarding the Navy's Inpatient Data System. The Naval Hospitals at Great Lakes and Orlando subcategorized some admissions differently. This made it difficult to achieve great detail in examination of admissions. For example, one facility might classify a acute cellulitis patient under "Dermatology" and the other under "Medical Care not elsewhere classified" (Miscellaneous). In those cases, the most common denominator was used which, for the cellulitis case, would be under the "Medical Directorate". The resulting six admission categories were divided on organizational and practical grounds. The two major categories under total admissions are the Medical Directorate and the Surgical Directorate. One subcategory, psychiatry, could be drawn from the data in medical and two in surgical which are orthopedics and gynecology. Therefore, the admissions categories used in this project are:

1. Total Admissions
2. Medical Directorate
3. Psychiatry Department (Subset of Medical)
4. Surgical Directorate
5. Orthopedics Department (Subset of Surgical)
6. Gynecology Department (Subset of Surgical)

5. MEDICAL BOARD CATEGORIES

Medical Boards were thought to be another useful and relevant area to address in this project. It can not only provide some insight as to the administrative burden of actually conducting the medical boards, but also there is some indication of medical attrition and even the severity of illness, since only serious cases are "boarded out". The data was gathered manually from logs and other files at each command. Therefore, unlike the automated admission data, there was greater control of the categorization. The categories were also constructed along organizational lines, i.e., directorates and departments. The categories for medical board analysis are:

1. TOTAL MEDICAL BOARDS
2. SURGICAL DIRECTORATE
3. General Surgery Department
4. Gynecology/Obstetrics Department
5. Opthalmology Department
6. Orthopedics Department
7. Otorhinolaryngology Department
8. Podiatry Department
9. Urology Department
10. MEDICAL DIRECTORATE
11. Dermatology Department
12. Internal Medicine Department
13. Neurology Department
14. Psychiatry Department

APPENDIX B

STATISTICAL FORMULAS

X^2 Formula

1. Objective: For this project, it is necessary to test the statistical significance of sex differentiated values in Phase 1 and projected values in Phase 2.

2. Criteria: There are three criteria that must be met for X^2 to be correctly applied. 1) All observations must be independent. 2) No expected values may be less than 1. 3) All expected values must be greater than 5.

3. Applicability: The X^2 test was suitably applied to every category and subcategory where definite independent measurements could be made. In the case of 8 outpatient workload categories (Total visits, Laboratory, Pharmacy, Radiology, Immunizations, General Practice Clinic, Podiatry Clinic and Optometry Clinic), it could not be ruled out that one patient could receive multiple units of care. These eight categories are not well suited for X^2 calculations so the testing the difference of the population proportion and the category proportion was performed (see #2 in this Appendix).

4. Procedure: After setting up the 2x2 contingency table for a given category, the next step is to calculate expected frequencies for each cell. These expected frequencies are calculated using the formula:

$$E_{i,j} = \frac{(R_i)(C_j)}{n}$$

Where: $E_{i,j}$ = expected value of each cell
R_i = row total for i^{th} row
C_j = column total for j^{th} column
n = total sample size

The results of the expected frequencies calculations are then used in the formula that provides the actual X^2 statistic for the category of concern:

$$X^2 = \Sigma \frac{(O-E)^2}{E}$$

Where: O = observed frequencies
E = calculated expected frequencies

The result of $X^2_{calculated}$ is then compared to the $X^2_{critical}$ to accept or reject H_0. For this project, the $X^2_{critical}$ with 1 degree of freedom at a 95% confidence level is 3.841.

In phase two it is neither possible nor useful to compare male and female data. However, it is important to determine if the integrated male/female population's characteristics are significantly different from the previous all-male population. For the second phase of the project, the samples to be compared are the "old" Great Lakes FY 85 all-male recruit sample and the "new" Great Lakes FY 87 male-female recruit sample.

5. Example of X^2 calculations: For single vision glasses made for issue to a recruit.

a. The hypotheses to be tested:

H_0: There is no difference in the frequency of glasses issued between male and female recruits.

H_a: There is a difference in the frequency of glasses issued between male and female recruits.

b. The contingency table is constructed:

	Glasses Issued	Glasses NOT Issued	Total
Males	6,725	11,555	18,280
Females	4,613	6,553	11,166
TOTAL	11,338	18,108	29,446

c. Using the formula above for calculating expected values:

$$\text{Expected Males Issued} = \frac{(11,338)(18,280)}{29,446} = 7038.60$$

$$\text{Expected Females Issued} = \frac{(11,338)(11,166)}{29,446} = 4299.39$$

$$\text{Expected Males NOT Issued} = \frac{(18,280)(18,108)}{29,446} = 11241.39$$

$$\text{Expected Females NOT Issued} = \frac{(11,166)(18,108)}{29,446} = 6866.60$$

d. The results of the expected frequencies calculations are then used in the formula that provides the actual X^2 statistic for glasses issued:

$$X^2 = \frac{(6725-7038.60)^2}{7038.60} + \frac{(4613-4299.39)^2}{4299.39} + \frac{(11555-11241.39)^2}{11241.39} + \frac{(6553-6866.60)^2}{6866.60}$$

$$= 13.97 + 22.87 + 8.74 + 14.32$$

= 59.90

e. Conclusion: $X^2_{calculated}$ of 59.90 is greater than $X^2_{critical}$ of 3.841; therefore reject H_0 and conclude that there is a significant difference between males and females with respect to fabrication and issue of glasses ($p > .001$).

6. SOURCE: Daniel, Wayne W. Biostatistics: A Foundation for Analysis in the Health Sciences. 2nd Ed. John Wiley and Sons (New York: 1978). p. 356.

Test of the Difference Between Two Proportions

1. Applicability: This test was selected to determine the statistical significance of those eight outpatient workload categories that did not meet the criteria of independence for a X^2 test.

2. Assumptions: It is assumed that the sampling distribution of the difference between these two proportions is normal, with a mean of $p_1 - p_2$, and a standard error of

$$\sqrt{\frac{\bar{p}(1-\bar{p})}{n_1} + \frac{\bar{p}(1-\bar{p})}{n_2}}$$

when the null hypothesis is true and the sample estimates are pooled such that

$$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

Where: x_1 = total male recruits
n_1 = total recruits
x_2 = total work units for males
n_2 = total work units for all recruits

3. Procedure: The hypotheses to be tested for these eight categories are:

$$H_0: p_1 - p_2 = 0$$
$$H_a: p_1 - p_2 \neq 0$$

The Z score is calculated by:

$$Z = \frac{(\hat{p}_1 - \hat{p}_2) - 0}{\sqrt{\frac{\bar{p}(1-\bar{p})}{n_1} + \frac{\bar{p}(1-\bar{p})}{n_2}}}$$

Where: $\hat{p}_1$ = actual total proportion of males
$\hat{p}_2$ = actual proportion of male work units

The result of this calculation ($Z_{calculated}$) is then compared to the $Z_{critical}$ to accept or reject H_0. For this project, the $Z_{critical}$ for a two tailed test at the 95% confidence level is 1.96. If H_0 is rejected, it may be concluded that there is a statistically significant difference between the proportion of males to females and the proportion of male to female work units.

For the second phase of the project, the sample proportions to be compared are the "old" Great Lakes FY 85 all-male recruit sample and the "new" Great Lakes FY 87 male-female recruit sample. If there is no difference between these two samples, then each should represent .5 (half) of their sum. In this case, the Z calculations will determine whether the variation from .5 is (or is not) significant.

4. Example of the Z score calculations: Pharmacy units issued.

a. Formulate the hypotheses to be tested:
H_0: There is no difference between the proportion of males and the proportion of prescriptions issued to males OR $p_1 - p_2 = 0$ where p_1 is the proportion of males and p_2 = proportion of prescriptions given to males.
H_a: There is a difference between the proportion of males and the proportion of prescriptions issued to males OR $p_1 - p_2 \neq 0$.

b. Data:
x_1 = 18280 (total male recruits)
n_1 = 29446 (total recruits)
$\hat{p}_1$ = .6211 (proportion of male recruits)
x_2 = 85454 (total pharmacy units for males)
n_2 = 142308 (total units for all recruits)
$\hat{p}_2$ = .6004 (proportion of male pharmacy units)

c. Calculate the pooled variance:

$$\bar{p} = \frac{18289 + 85454}{29446 + 142308} = .6040$$

d. Calculate the Z score:

$$Z = \frac{(.6211 - .6004) - 0}{\sqrt{\frac{.6040(1-.6040)}{29446} + \frac{.6040(1-.6040)}{142308}}}$$

$$Z = \frac{.0207}{\sqrt{\frac{.2391}{29446} + \frac{.2391}{142308}}}$$

$$Z = \frac{.0207}{\sqrt{.0000081 + .0000017}}$$

$$Z = 6.61$$

e. Conclusion: $Z_{calculated}$ of 6.61 is greater than $Z_{critical}$ of 1.96; therefore reject H_0 and conclude that there is a significant difference between the proportion of males getting prescriptions and the general population. Therefore, it is also true that the proportion of females getting prescriptions ($1-\hat{p}$) differs from the general population of female recruits.

SOURCE: Daniel, Wayne W. Biostatistics: A Foundation for Analysis in the Health Sciences. 2nd Ed. John Wiley and Sons (New York: 1978). p. 190.

APPENDIX C

Table 10

STAFFING COMPARISON
Branch Clinics
Naval Hospitals, Orlando FL and Great Lakes IL

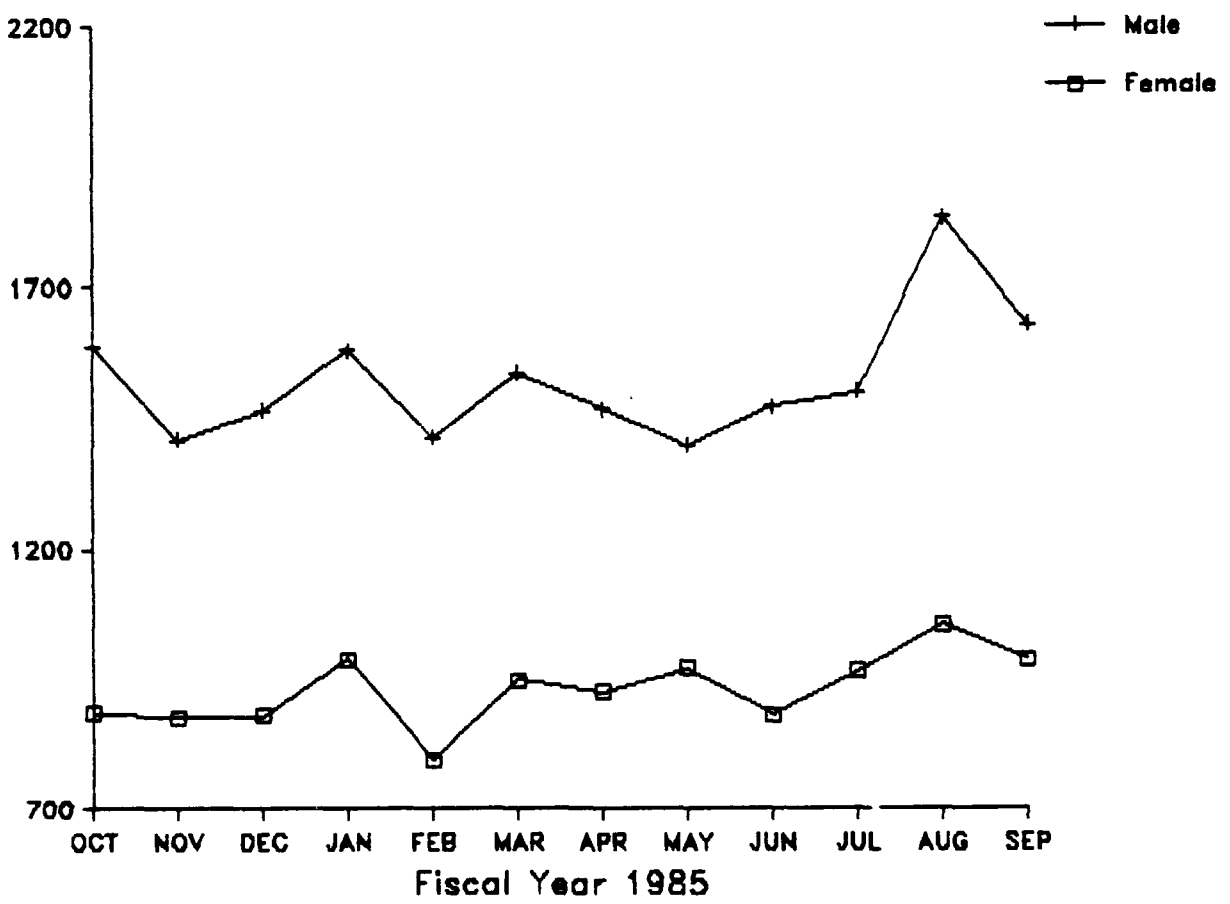
	Orlando			Great Lakes		
	Officer	Enl	Civ	Officer	Enl	Civ
Clinic Director.....	1(MSC)			1(MSC)		
Administration.....		2	1		4	
Recruit Medical Boards...		2	1		2	
Supply/Master at Arms....		4			2	
QA/Education.....		1		1(NC)		
Recruit Medical Records..		8			10	1
Medical Coordinator.....		2			2	
Ancillary Services.....	1(NC)					
Laboratory.....		5			2	
Pharmacy.....		3			2	
Radiology.....		1	1		3	
Operational Medicine.....	1(MC)					
Female Recruit Sick Call.	1(MC)	7				
Male Recruit Sick Call...	2(MC)			3(MC)		
	2(PA)	13		4(PA)	8	
Physical Examinations....	1(MC)	8	1(MD)		7	
			1			
Podiatry.....	1(MSC)	2		2(MSC)	5	
Optometry.....	2(MSC)	10		2(MSC)	8	
Recruit Evaluation Unit	1(MC)	3	1	1(MSC)	5	1
Recruit Medical Inprocessing..		12			12	
TOTAL.....	13	83	6	14	72	2

Note: Some organizational titles were modified to facilitate comparison.

APPENDIX D
RTC ORLANDO STUDENT FLOW

Figure 2

ORLANDO MONTHLY STUDENT FLOW
Recruit Training Command, Orlando FL



APPENDIX E

WORKLOAD ANALYSIS

Table 11

RECRUIT OUTPATIENT WORKLOAD DATA
Naval Hospital, Orlando FL
Fiscal Year 1985

	TOTAL	AVE	RATE	RATIO	X^2	Z Score
Flight Physical Exams						
Male.....	385	32	21.06	2.41	195.67***	
Female.....	567	47	50.78			
Electrocardiograms						
Male.....	435	36	23.80	2.07	138.13***	
Female.....	549	46	49.17			
Podiatry Visits						
Male.....	3,564	297	194.96	1.50		14.97***
Female.....	3,259	272	291.87			
Laboratory Procedures						
Male.....	125,225	10,435	6,850.20	1.24		16.79***
Female.....	94,741	7,895	8,484.78			
General Medicine Clinic						
Male.....	31,380	2,615	1,716.58	1.17		10.98***
Female.....	22,432	1,869	2,008.96			
Glasses Fabricated						
Male.....	6,725	560	367.88	1.12	59.91***	
Female.....	4,613	384	413.13			
Total Outpatient Visits						
Male.....	54,296	4,525	2,970.16	1.12		8.05***
Female.....	37,058	3,088	3,318.83			
Pharmacy Units						
Male.....	85,454	7,121	4,674.60	1.09		6.48***
Female.....	56,854	4,738	5,091.71			
Total Physical Exams						
Male.....	1,004	84	54.92	1.06	1.26	
Female.....	646	54	58.03			
Optometry Refractions						
Male.....	3,729	311	203.99	1.05	3.74	
Female.....	2,383	199	213.42			
Optometry Clinic Visits						
Male.....	19,472	1,623	1,065.18	1.03		1.57
Female.....	12,211	1,018	1,093.59			
X-ray Film Exposures						
Male.....	8,062	672	441.02	1.00		.06
Female.....	4,931	411	441.61			
Immunizations						
Male.....	126,151	10,513	6,900.85	.96		-3.24***
Female.....	73,909	6,159	6,619.11			

***p < .005

APPENDIX F

MORBIDITY ANALYSIS

Table 12

RECRUIT OUTPATIENT MORBIDITY DATA
Naval Hospital, Orlando FL
Fiscal Year 1985

MORBIDITY CATEGORY	TOTAL	AVE	RATE	RATIO	X^2
Obstetric Related Disorders					
Male.....	0	0	.00	N/A	N/A
Female.....	982	82	87.95		
Endocrine Disorders					
Male.....	5	0	.27	15.06	59.30***
Female.....	46	4	4.12		
Genitourinary Disorders					
Male.....	321	27	17.56	7.76	1664.27***
Female.....	1,521	127	136.22		
Musculoskeletal Disorders					
Male.....	3,030	253	165.75	2.48	2162.18***
Female.....	4,581	382	410.26		
Digestive Disorders					
Male.....	645	54	35.28	2.42	340.54***
Female.....	955	80	85.53		
Circulatory Disorders					
Male.....	559	47	30.58	1.46	38.90***
Female.....	497	41	44.51		
Dermatologic Disorders					
Male.....	3,198	267	174.94	1.20	54.40***
Female.....	2,340	195	209.56		
Mental Disorders					
Male.....	435	36	23.80	.99	.01
Female.....	263	22	23.55		
Reactive Tuberculin Tests					
Male.....	96	8	5.25	.77	2.17
Female.....	45	4	4.03		
Respiratory Disorders					
Male.....	7,622	635	416.95	.76	293.51***
Female.....	3,541	295	317.12		
Accidents/Injuries					
Male.....	4,844	404	264.98	.61	422.65***
Female.....	1,806	151	161.74		
Infectious Disease					
Male.....	2,012	168	110.06	.56	199.33***
Female.....	683	57	61.17		
Venereal Disease					
Male.....	511	43	27.95	.42	85.53***
Female.....	131	11	11.73		

***p < .005

Figure 3
RECRUIT MUSCULOSKELETAL DISORDERS (NON-TRAUMA)
Naval Hospital Orlando FL
Monthly Rates per 1,000 Recruits for FY 1985

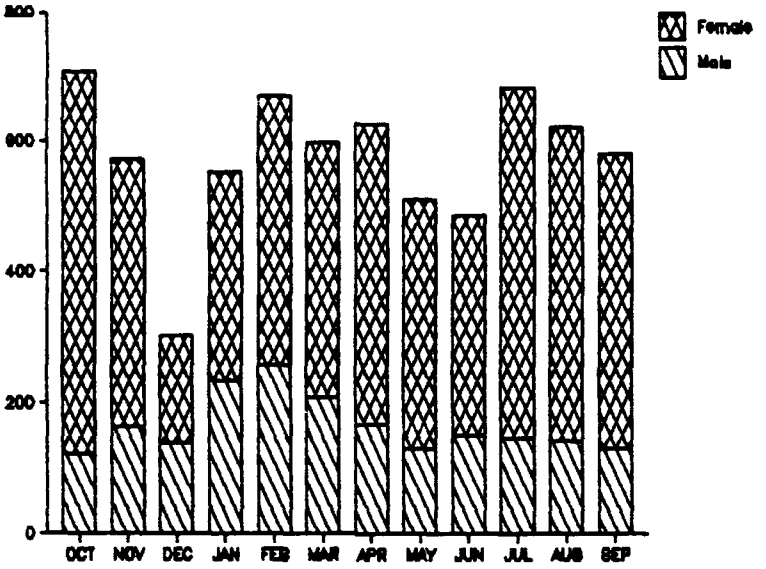


Figure 4
RECRUIT ACCIDENTS/INJURIES (TRAUMA)
Naval Hospital Orlando FL
Monthly Rates per 1,000 Recruits for FY 1985

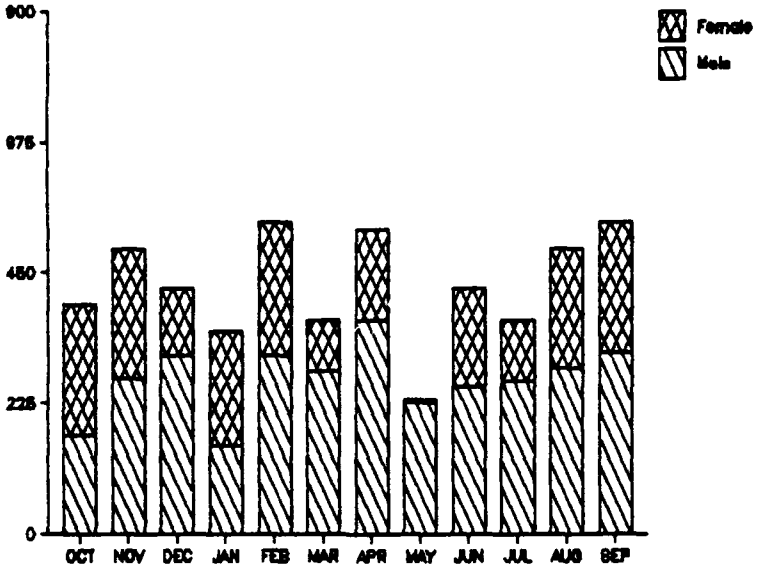


Figure 5
MALE RECRUIT ORTHOPEDIC CASES
Naval Hospital Orlando FL
Monthly Rates per 1,000 Recruits for FY 1985

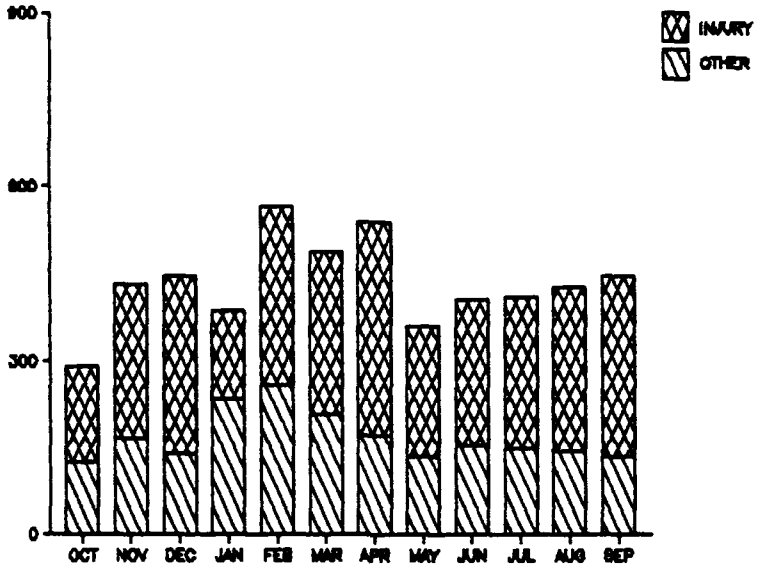
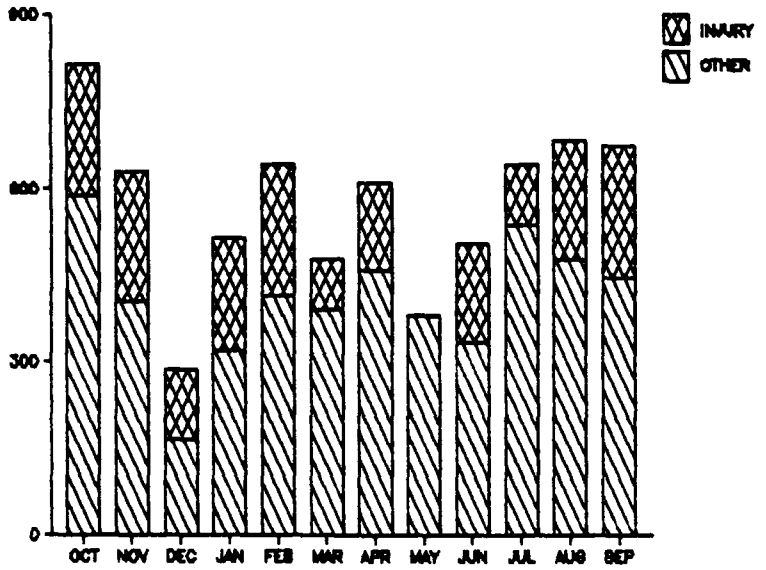


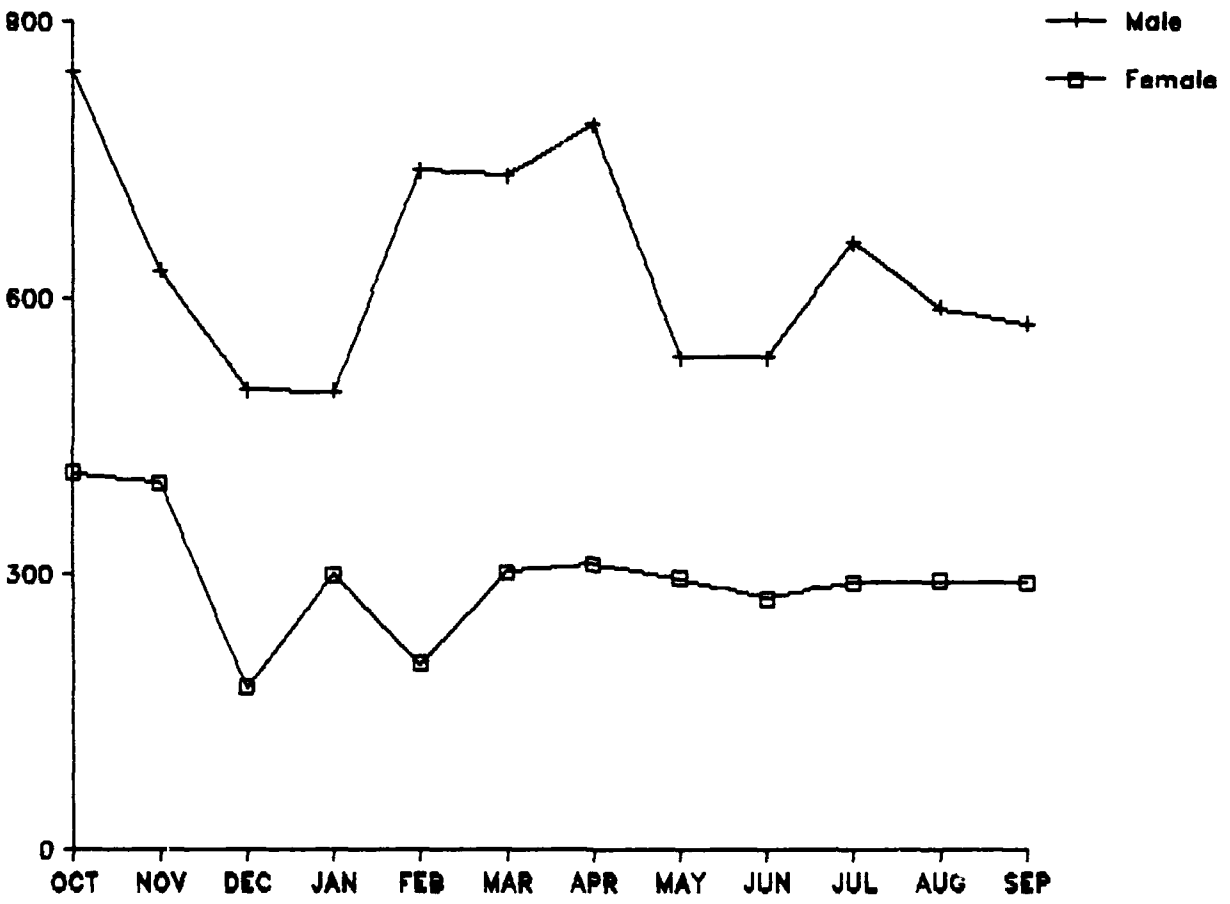
Figure 6
FEMALE RECRUIT ORTHOPEDIC CASES
Naval Hospital Orlando FL
Monthly Rates per 1,000 Recruits for FY 1985



APPENDIX F (continued)

Figure 7

RECRUIT RESPIRATORY DISORDERS BY SEX
Naval Hospital Orlando FL
Monthly Rates per 1,000 Recruits for FY 1985



APPENDIX G

ADMISSION ANALYSIS

Figure 8

MONTHLY RECRUIT ADMISSION RATES BY SEX
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985

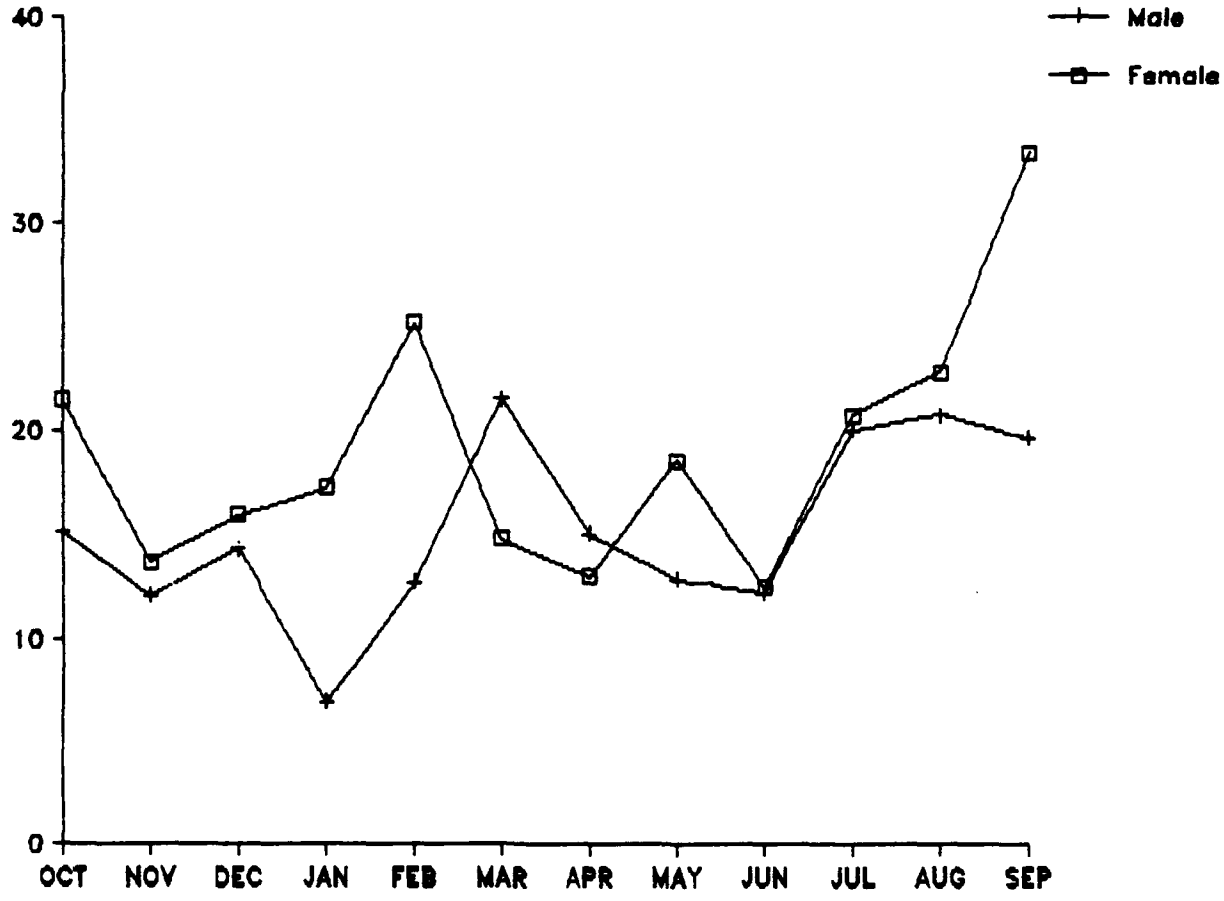


Figure 9
MONTHLY MEDICINE ADMISSION RATES BY SEX
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985

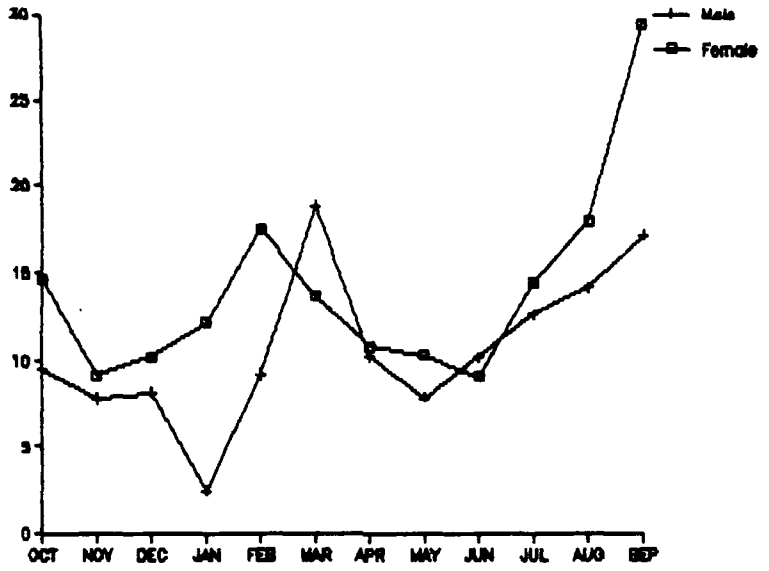
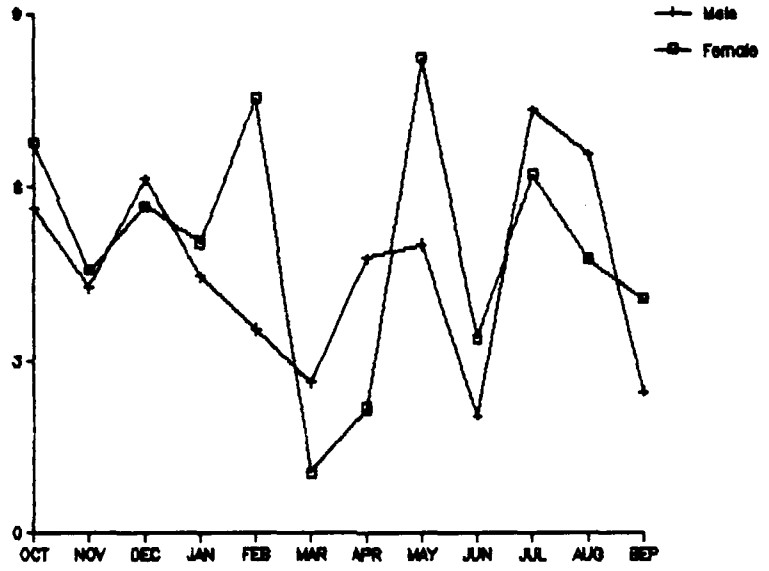


Figure 10
MONTHLY RECRUIT SURGICAL ADMISSION RATES BY SEX
Naval Hospital Orlando FL
Rates per 1,000 Recruits for FY 1985



APPENDIX H

MEDICAL BOARD ANALYSIS

Table 13

MEDICAL BOARD DATA
Naval Hospital, Orlando FL
Fiscal Year 1985

	Total	Ave	Rate	Ratio	X^2
ALL MEDICAL BOARDS					
Male.....	833	69.42	45.56	.85	7.92***
Female.....	431	35.92	38.60		
SURGICAL DIRECTORATE					
Male.....	627	52.25	34.30	.73	19.34***
Female.....	281	23.42	25.16		
Otorhinolaryngology					
Male.....	34	2.83	1.86	..43	5.28*
Female.....	9	.75	.81		
Opthalmology					
Male.....	22	1.83	1.20	1.49	1.68
Female.....	20	1.67	1.79		
Gynecology					
Male.....	0	.00	.00	N/A	Note 1
Female.....	11	.92	.99		
Orthopedic					
Male.....	407	33.92	22.26	.66	21.46***
Female.....	163	13.58	14.60		
Podiatry					
Male.....	107	8.92	5.85	.98	.01
Female.....	64	5.33	5.73		
General Surgery					
Male.....	38	3.17	2.08	.34	8.24***
Female.....	8	.67	.72		
Urology					
Male.....	19	1.58	1.04	.52	2.05
Female.....	6	.50	.54		
MEDICINE DIRECTORATE					
Male.....	206	17.17	11.27	1.19	2.71
Female.....	150	12.50	13.43		
Dermatology					
Male.....	31	2.58	1.70	1.00	.00
Female.....	19	1.58	1.70		
Internal Medicine					
Male.....	153	12.75	8.37	1.21	2.37
Female.....	113	9.42	10.12		
Neurology					
Male.....	12	1.00	.66	.82	.16
Female.....	6	.50	.54		
Psychiatry					
Male.....	10	.83	.55	1.96	2.58
Female.....	12	1.00	1.07		

*p < .05
**p < .01
***p < .001

1. Unable to compute X^2 statistic since the expected values for females with Gynecological Medical Boards was 4.17 which is less than the required value of 5.

APPENDIX I

PROJECTIONS

Table 14

PROJECTED RECRUIT WORKLOAD DATA
Naval Hospital, Great Lakes IL
Fiscal Year 1987

	FY 85 Total	FY 87 Projections Male	+ Female	= Total	Difference Yearly	Monthly	Ratio	X^2	Z Score
Flight Physicals.....	371	330	96	426	55	5	1.15	3.84*	
Electrocardiograms.....	571	509	127	636	65	5	1.11	3.56	
Podiatry Clinic.....	14,025	12,505	2,275	14,780	755	63	1.05		3.77***
Laboratory Procedures..	117,955	105,172	15,831	121,003	3,048	254	1.03		3.03***
General Practice.....	182,034	162,307	23,085	185,392	3,358	280	1.02		2.27*
Glasses Fabricated.....	12,278	10,947	1,494	12,441	163	14	1.01	1.62	
Outpatient Visits.....	273,170	243,567	33,076	276,643	3,473	289	1.01		1.61
Pharmacy Units.....	167,546	149,389	19,775	169,164	1,618	135	1.01		1.18
All Physical Exams.....	14,313	12,761	1,638	14,399	86	7	1.01	.42	
Optometry Refractions..	7,087	6,319	803	7,122	35	3	1.00	.11	
Optometry Clinic.....	53,499	47,701	5,951	53,652	153	13	1.00		.39
X-ray Film Exposures...	41,078	36,626	4,457	41,083	5	0	1.00		.01
Immunizations.....	332,433	296,488	34,552	330,960	-1,473	-123	1.00		-.57

*p < .05
***p < .005

Table 15

PROJECTED RECRUIT MORBIDITY DATA
Naval Hospital, Great Lakes IL
Fiscal Year 1987

	FY 85 Total	FY 87 Projection Male + Female = Total			Difference Yearly	Difference Monthly	Ratio	X^2
Obstetric Related Disorders.	0	0	351	351	351	29	N/A	352.68***
Endocrine Disorders.....	14	12	22	34	20	2	2.43	8.34***
Genitourinary Disorders.....	376	335	316	651	275	23	1.73	74.68***
Musculoskeletal Disorders...	7,582	6,760	2,033	8,793	1,211	101	1.16	115.09***
Digestive Disorders.....	923	822	242	1,064	141	12	1.15	10.28**
Circulatory Disorders.....	510	454	80	534	24	2	1.05	.56
Dermatology Disorders.....	4,012	3,577	520	4,097	85	7	1.02	1.00
Mental Disorders.....	87	77	9	86	-1	0	.99	.006
Respiratory Disease.....	12,968	11,562	1,068	12,630	-338	-28	.97	6.83**
Reactive Tuberculin Tests...	205	182	17	199	-6	-1	.97	.09
Accidents/Injuries.....	6,983	6,226	461	6,687	-296	-25	.96	7.87**
Infective Disease.....	2,894	2,580	174	2,754	-140	-12	.95	3.76
Venereal Disease.....	443	394	20	414	-29	-2	.93	.99

**p < .01
***p < .005

Table 16

PROJECTED RECRUIT ADMISSIONS DATA
Naval Hospital, Great Lakes IL
Fiscal Year 1987

	FY 85 Total	FY 87 Projection Male	+ Female	= Total	Difference Yearly	Monthly	Ratio	X^2
ALL ADMISSIONS.....	596	531	80	612	16	1.30	1.03	.21
MEDICAL DIRECTORATE.....	397	354	57	411	14	1.13	1.03	.39
Psychiatry.....	113	101	20	121	8	.63	1.07	.27
SURGICAL DIRECTORATE.....	199	177	23	201	2	.13	1.01	.01
Orthopedics.....	81	72	9	81	0	-.01	1.00	.00
Gynecology.....	0	0	6	6	6	.54	N/A	NOTE 1

1. Unable to compute X^2 statistic since the expected values for Gynecological Admissions was 3 which is less than the required value of 5.

APPENDIX I (continued)

Table 17

PROJECTED RECRUIT MEDICAL BOARD DATA
Naval Hospital, Great Lakes IL
Fiscal Year 1987

	FY 85 Total	FY 87 Projection Male	+ Female	= Total	Diff/Yr	Ratio	X^2
ALL MEDICAL BOARDS.....	1,362	1,214	149	1,363	1	1.00	.00
SURGICAL DIRECTORATE.....	769	686	63	748	-21	.97	.33
General Surgery.....	25	22	1	23	-2	.93	.08
Gynecology.....	0	0	4	4	4	N/A	NOTE 1
Opthalmology.....	69	62	11	73	4	1.05	.11
Orthopedics.....	469	418	33	451	-18	.96	.36
Otorhinolaryngology.....	113	101	5	106	-7	.94	.22
Podiatry.....	57	51	6	57	0	1.00	.02
Urology.....	36	32	2	34	-2	.95	.06
MEDICINE DIRECTORATE.....	593	529	86	615	22	1.04	.41
Dermatology.....	49	44	5	49	0	1.00	.00
Internal Medicine.....	272	243	36	278	6	1.02	.07
Neurology.....	103	92	9	101	-2	.98	.02
Psychiatry.....	169	151	36	187	18	1.10	.92

1. Unable to compute X^2 statistic since the expected values for females with Gynecological Medical Boards was 2 which is less than the required value of 5.

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